

THE MINERAL INDUSTRY OF SOUTH AFRICA

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The Republic of South Africa holds a major economic and physical presence on the African continent. Its rich natural-resource endowment serves as a base for one of the strongest economies in Africa with a gross domestic product (GDP) based on purchasing-power-parity data for 2002 of \$427.7 billion and a GDP per capita of \$10,400;¹ it ranks fifth in population and land area on the continent with 42.8 million people and 1,219,912 square kilometers. During 2002, its export-oriented economy had a real growth rate of 3% and an inflation rate of 9.9% (International Monetary Fund, 2003§;² U.S. Central Intelligence Agency, 2003§). The 8-year-long devaluation of the rand against the U.S. dollar appeared to have ended in December 2001 when the monthly average exchange rate depreciated from 3.07 rands to the dollar in January 1993 to 11.59 rands to the dollar in December 2001. During 2002, the rand appreciated by 23% against the dollar to 8.94 rands by yearend 2002. The rand appreciation, however, had implications for the mining and mineral-processing sector because its dollar-denominated exports brought in fewer rands to meet domestic rand-denominated operating costs.

According to the Ministry of Mines and Energy's Department of Minerals and Energy (DME), in 2002, South Africa produced more than 56 different mineral commodities from about 778 mines and quarries, which included 57 coal, 51 diamond, 33 gold, and 17 platinum-group metals (PGMs) operations.

It ranked first in the world in the production of aluminosilicates (andalusite), chromite, ferrochrome, gold, manganese, and PGMs and second for fluorspar, titanium minerals (chiefly ilmenite), vanadium, vermiculite, and zirconium. Mining and quarrying contributed \$7.7 billion, or 8.1%, to the GDP in 2002, and, if the indirect multiplier effects of the industry, such as related service and supply industries, are included, then the overall contribution of mining to GDP is estimated to be 12%. According to the Chamber of Mines of South Africa (2003§), the mining companies have committed to invest about \$9.6 billion in capital projects between 2003 and 2007.

The most important mineral commodities produced in South Africa were, in terms of value in declining order, PGMs, gold, coal, ferroalloys (ferrochromium, ferromanganese, ferrosilicon, and ferrovandium), aluminum, steel, titanium, iron ore, diamond, vanadium, and copper. Additionally, important output of metallic commodities included antimony, chromite, cobalt, lead, manganese, nickel, silver, uranium, zinc, and zirconium.

¹Where necessary, values have been converted from South African rands (R) to U.S. dollars at the rate of R10.54=US\$1.00 for 2002 and R8.61=US\$1.00 for 2001.

²References that include a section mark (§) are found in the Internet References Cited section.

Significant industrial minerals production included andalusite, aggregate and sand, asbestos, dimension stone, fluorspar, lime and limestone, phosphate rock, sulfur, and vermiculite. South Africa was a major producer and the world's third leading exporter of coal and the largest producer of synthetic liquid fuels and petrochemicals derived from coal. South Africa's well-developed railway and port infrastructure served the domestic minerals industry and those in neighboring countries.

Government Policies and Programs

The DME is the primary Government entity responsible for the establishment and implementation of minerals and energy policy and for oversight of the country's mineral industry. Within the DME are the Mineral Development Branch, which is responsible for regional mineral development, mineral economics (Minerals Economics Directorate), mine rehabilitation, and mining rights; the Energy Branch, which promotes the optimum use of energy resources; and the Mine, Health and Safety Inspectorate. A number of parastatal institutions were associated with the DME; these included the Atomic Energy Corp.; the Council for Geosciences (formerly the Geological Survey of South Africa); the Council for Mineral Technology (Mintek), which is the parastatal mineral-research organization; the Council for Nuclear Safety; the National Electricity Regulator; the South African Diamond Board; and the Central Energy Fund (Pty.) Ltd. (CEF) through which the state's interest in the liquid fuel industry is owned, developed, and managed commercially.

On April 12, 2002, following 6 years of public and internal Government debate, the Minerals and Petroleum Resources Development Bill (B15D/2002) was passed by the National Assembly and the National Council of Provinces on June 25 and 26, 2002, and became law in October 2002. It replaced the Minerals Act, 1991 and the Minerals Amendment Act, 1993. The new Act provides for the equitable access to and sustainable development of the nation's mineral and petroleum resources. The objective criteria framework of the bill was stated in the preamble (Department of Minerals and Energy, 2002a§):

- Recognizes that minerals and petroleum are nonrenewable natural resources;
- Acknowledges that South Africa's mineral and petroleum resources belong to the nation and the state is the custodian thereof;
- Affirms the state's obligation to protect the environment for the benefit of present and future generations, to ensure ecologically sustainable development of mineral and petroleum resources, and to promote economic and social development;
- Recognizes the need to promote local and rural development and the social upliftment of communities affected by mining;

- Reaffirms the state's commitment to reform to bring about equitable access to South Africa's mineral and petroleum resources;
- Commits to eradicating all forms of discriminatory practices in the mineral and petroleum industries;
- Considers the state's obligation under the Constitution to take legislative and other measures to redress the results of past racial discrimination;
- Reaffirms the state's commitment to guaranteeing security of tenure in respect of prospecting and mining operations; and
- Emphasizes the need to create an internationally competitive and efficient administrative and regulatory regime.

Other key mineral-related legislation included the Mining Titles Registration Act, 1967; the Mining Titles Registration Amendment Act, 2003; the Central Energy Fund Act, 1977; the Petroleum Products Act, 1977; the Diamonds Act, 1986; the Electricity Act, 1987; the Mineral Technology Act, 1989; the Nuclear Energy Act, 1993; the Liquid Fuels and Oil Repeal Act, 1993; the Mineral and Energy Laws Rationalization Act, 1994 (which repealed the Mining Rights Act of 1967); and the Mine Health and Safety Act, 1996. A 1998 ruling by the Minister of Finance had set the corporate tax rate at 35% for all companies that entered into offshore oil and gas subleases with Soekor (Pty.) Ltd. by the end of 1999.

In October 2002, the Government released the Proposed Broad-Based Socio-Economic Empowerment Charter for the South Africa Mining Industry. The Mining Charter vision statement declares, "All the actions and commitments set out below are in the pursuit of a shared vision of a globally competitive mining industry that draws on the human and financial resources of all South Africa's people and offers real benefits to all South Africans. The goal of the empowerment charter is to create an industry that will proudly reflect the promise of a non-racial South Africa." The Mining Charter aims to redress historical and social inequalities suffered by historically disadvantaged South Africans (HDSA) by formalizing the mining industry's commitment "to adopt a proactive strategy of change to foster and encourage black economic empowerment (BEE) and transformation at the tiers of ownership, management, skills development, employment equity, procurement and rural development." The Mining Charter acknowledges the need to maintain South Africa's competitiveness in the international market- place and further states, "It is government's stated policy that whilst playing a facilitating role in the transformation of the ownership profile of the mining industry, it will allow the market to play a key role in achieving this end and it is not the government's intention to nationalize the mining industry." To facilitate this transformation, the mining companies, as stakeholders and signatories to the Charter, agreed to achieve 26% HDSA ownership of the mining industry assets by each mining company within 10 years; and to meet to review progress in 5 years. The industry also agreed to assist HDSA companies to secure financing to fund participation in an amount of R100 billion (\$1 billion) within the first 5 years. Under Charter mandates, the Government will provide support to HDSA exploration and prospecting efforts, and the mining industry will examine the potential for creating value-added beneficiated and consumer products in South Africa. A proposed formal

"scorecard" system for companies to report their progress to the Government in meeting these Mining Charter objectives was released in February 2003 (Department of Minerals and Energy, 2002b§, 2003a§).

Environmental Issues

The Department of Environmental Affairs and Tourism (DEAT) is the focal point for environmental planning and management within South Africa. The DEAT has been developing a comprehensive set of geospatial data and environmental indicators for use in national environmental and land-use planning and resource management, which are accessible through its Web site via URL <http://www.environment.gov.za>. The DEAT implements the National Environmental Management Act (107 of 1998) (NEMA), which created a framework for environmental management in South Africa, and established principles for sustainable development, procedures for coordinating the environmental functions of Government, and mechanisms for civil society participation.

As required under the NEMA, the DME put the Environmental Management Plan that addressed mineral sector issues in place during 2000 (Department of Minerals and Energy, 2001§).

Production

In 2002, South Africa was one of the largest and most diverse minerals producers in the world. Mineral production statistics are listed in table 1. For 2002, the DME Minerals Economics Directorate (formerly the Minerals Bureau) reported the value of primary mined products to be \$12.9 billion and that of processed mineral products to be \$2.26 billion. In addition, hydrocarbons were valued at \$229 million. The mining and quarrying sector paid out \$2.8 billion in wages and more than \$675 million in taxes to the Government. On a value basis, about 23% of processed mineral materials and 20% of primary mined products were consumed domestically in 2002. Coal exports remained constant at approximately 69 million metric tons (Mt) between 2001 and 2002; in 2001, of the 151 Mt of coal consumed domestically, 89 Mt went for power generation, and 39 Mt, for value-added synthetic fuel and petrochemicals production. Because of South Africa's natural comparative advantage in its mineral-resource endowment of chromite, coal, iron ore, manganese, and nickel, these minerals were consumed domestically and further processed into such intermediate and finished products as ferroalloys and steel products for export to world markets (Department of Minerals and Energy, 2003b§).

Trade

Primary mineral exports totaled \$10.5 billion and accounted for 34% of all merchandise trade in 2002. Adding beneficiated exports to primary mineral exports, the minerals sector accounted for 60% of total merchandise exports. The decline in PGM prices and the increase in the gold price saw gold return to its historical spot as the number one export earner as gold export sales of \$3.96 billion in 2002 exceeded PGM exports of \$3.33 billion. The next leading exports were coal at \$2.98 billion and

diamond. Although diamond export data are not published, the value of rough diamond production was estimated to be more than \$1 billion. Ferrous metal exports were valued at \$749.2 million; industrial minerals, \$515.9 million; and nonferrous metals, \$508.4 million. In addition to exports of mine and quarry products, \$2.26 billion in value-added processed mineral products was exported in 2002. Of that total, ferroalloys accounted for \$933.8 million; aluminum, \$672.7 million; and vanadium, \$109.5 million. Imports for 2002 included \$1.99 billion of primary and processed mineral products, primarily industrial mineral products (\$721.4 million), diamond (\$468.8 million), and nonferrous metals (\$370.1 million) and \$3.25 billion in petroleum and petroleum products resulting in a net positive mineral and fuel merchandise trade balance of about \$13.3 billion (Department of Minerals and Energy, 2003b§).

Structure of the Mineral Industry

The South African minerals and energy industries operated on a free enterprise, market-driven basis. Ownership of mineral rights was historically held by either the Government or private entities. Mineral rights would revert to the State under terms of the Minerals and Petroleum Resources Development Bill of 2002, and companies will have a 5-year period to convert its “old order” exploration and mining rights into new rights under terms of the new legislation. Direct Government involvement in these sectors was minimal and primarily confined to ownership of the national electric power utility (Eskom), the national oil and gas exploration company [Southern Oil Exploration Co. (Soekor)], and the two parastatal synthetic fuel companies [Mossgas (Pty.) Ltd. and Sasol Limited]. In July 2000, CEF merged the parastatal companies Mossgas and Soekor into a new corporation, the Petroleum Oil and Gas Corporation of South Africa (Pty) (PetroSA), which remained as a wholly owned subsidiary of CEF. PetroSA’s mission is to develop and exploit the crude oil and gaseous hydrocarbon resources of South Africa effectively.

In South Africa, the bulk of mineral land holdings and production had been historically controlled by five mining investment houses. Since 1994, however, the industry has undergone a major corporate restructuring, or “unbundling,” aimed at simplifying a complex system of interlocking ownership that existed in the past, establishing separate core-commodity-focused profit centers, and diversifying and rationalizing nonperforming assets to make the newly restructured companies more competitive internationally. By 2002, several new black economic empowerment firms, which included African Rainbow Mining Ltd., Eyesizwe Coal (Pty) Ltd., African Vanguard Resources, and Mvelaphanda Platinum (Pty) Ltd., were establishing their mining portfolios and were expected to play an increasing role in the industry during the next 10 years. The structure and ownership of the industry as of mid-2003 is shown in table 2.

The Chamber of Mines, whose members represent the majority of coal, gold, and uranium producers, was responsible for a variety of advisory and service functions for mining interests in South Africa. One of its main activities was the annual wage negotiations between member mines and the National Union of Mineworkers.

Commodity Review

Metals

Aluminum.—During 2002, BHP Billiton Aluminium South Africa Ltd. was the sole producer of primary aluminum from its Bayside smelter and the newer Hillside smelter at Richards Bay. For the fiscal year that ended on June 30, 2003, the Hillside smelter increased production slightly to 534,000 metric tons (t) of aluminum metal compared with 502,000 t in the previous fiscal year. Production at the Bayside smelter increased to 184,000 t of aluminum in fiscal year 2002-03 compared with 175,000 t in fiscal year 2000-01. In April 2002, BHP Billiton will begin construction on the \$449 million Hillside III Expansion Program, which will expand Hillside smelting capacity by another 130,000 metric tons per year (t/yr) of aluminum to 640,000 t/yr by late calendar year 2003 (BHP Billiton Plc, 2002).

Antimony.—Metorex Ltd. (a subsidiary of Crew Development Corp. of Canada, which operated the Consolidated Murchison Mine near Gravelotte in the Northern Province) was South Africa’s only producer of antimony (as stibnite concentrate). For the fiscal year that ended on June 30, 2002, Consolidated Murchison Ltd. treated 40,000 metric tons per month (t/mo) that averaged 1.3% antimony and 2 grams per metric ton (g/t) gold. Recovery rates were 87.55% for antimony and 97.65% for gold. Production for the year included 9,000 t of stibnite concentrates, which contained an average of 59% antimony, and 995 kilograms (kg) of gold (Metorex Ltd., 2003a§).

Chromium.—Responding to an increase in world stainless steel demand, chromite ore production increased by 17% in 2002 to 6.44 Mt, which was equal to 46% of world supply. South Africa was the global leader in chromite ore production and export. Production came from more than 20 mines located within the Bushveld Ultramafic Complex. About 85% of the ore went to supply domestic ferrochrome smelters, and the remainder was exported. Domestic consumption of chromite ore was the highest in the world and fed the world’s leading ferrochrome industry and one of the world’s major chromium chemicals and refractories industries. Chromite ore sales were valued at about \$105 million in 2002, of which about \$30 million was export revenue (Department of Minerals and Energy, 2003b§).

For the fiscal year that ended on June 30, 2003, BHP Billiton’s Samancor Group, which was the world’s largest integrated ferroalloys producer, produced 2.83 Mt of chromite ore and 990,000 t of chrome alloys compared with 2.45 Mt of chromite ore and 837,000 t of chrome alloys in the previous fiscal year. Samancor’s operations were organized under two mining centers. Eastern Chrome Mines was based at Steelpoort, and Western Chrome Mines, at Mooinooi, near Rustenburg (BHP Billiton Plc, 2003§).

In March 2002, the Switzerland-based Xstrata AG transferred all its assets and liabilities to the newly formed United Kingdom company, Xstrata plc, with Glencore International AG holding a 40% controlling interest. Responding to demand

during 2002, Xstrata South Africa (Pty.) Ltd. restarted four ferrochrome furnaces—two at Wonderkop with a capacity of 170,000 t/yr and two at Rustenburg with a capacity of 140,000 t/yr; two furnaces with a combined capacity of 120,000 t/yr remained shut. Production of salable chrome ore for the year increased to 2.9 Mt from 1.5 Mt in 2001. The company's four captive chrome mines provided about 74% of feed to Xstrata ferrochrome plants; additional feed, which included chrome-bearing tailings from platinum mines, was purchased locally. Xstrata also continued to develop the Waterval chrome mine, which was scheduled to come onstream in 2004, and was constructing a second ore pelletizing line at its Wonderkop joint venture with Samancor (Xstrata plc, 2003§).

The Chrome Division of Assmang Ltd. operated the Dwarsrivier chrome mine and the Machadodorp ferrochrome works, both of which were located in Mpumalanga. For the financial year that ended on June 30, 2003, Assmang produced 20,000 t of chromite ore plus 244,000 t of charge chrome that originated from the Dwarsrivier Mine (Assmang Ltd., 2003b§).

During the financial year that ended on June 30, 2003, South African Chrome and Alloys Ltd., which was owned by the Royal Bafokeng Nation (35%) and Industrial Development Corporation of South Africa (24%), opened its new ferrochrome facility at Boshhoek, which is located near Rustenburg. The \$90 million facility included two 54-megavolt-ampere closed submerged electric-arc furnaces (EAFs) and a 520,000-t/yr pelletizing and sintering plant. Production capacity will be 235,000 t/yr of ferrochrome. Production will be sold to ThyssenKrupp Metallurgie GmbH of Germany. Feedstock for the Boshhoek smelter was supplied by the new Horizon Mine and a UG2 Reef chromite concentrator plant, which was located next to Impala Platinum Ltd. Start-up problems reduced ferrochrome production to 95,000 t for the year that ended on March 31, 2003, from the planned output of 145,000 t. Full operational capacity of 235,000 t/yr was expected by August 2003 (South African Chrome and Alloys Ltd., 2003§).

Copper.—Palabora Mining Company Limited, which was owned by Rio Tinto plc., operated the largest integrated copper complex in South Africa. On April 25, 2002, the operation transferred from an 80,000-metric-ton-per-day (t/d) open pit mine to an underground mine, which will mine 30,000-t/d of ore at an average grade of 0.8% copper. Owing to start-up problems, production was only at rate of 13,500 t/d by yearend. The \$380 million underground development project will extend the life of the mine for another 20 years. Palabora received a short-term loan of \$50 million in 2002 to meet start-up development costs. During 2002, Palabora treated 9.93 Mt with an average grade of 0.63% copper that yielded 52,197 t of copper anodes. In addition, the company produced 12,170 t of copper anodes from smelter secondaries and low-grade concentrate stockpiles and 16,633 t of copper anodes from imported concentrates, stockpiled concentrates, and copper scrap. The copper concentrate grade was 31.1% copper. The Palabora smelter produced 82,262 t of copper anodes, but the refinery output declined to 81,619 t of copper cathodes from 86,904 t in 2001. Production of value-added copper rod amounted to 73,513 t. Palabora also produced a variety of other products from the unique carbonatite mineralogy of

its deposit—a company record of 225,033 t of vermiculite concentrates, 117,238 t of sulfuric acid, 316 t of nickel sulfate, and 8,285 kg of precious metals contained in refinery tank house slimes. For the first time since 1971, no uranium oxide was produced. The Palabora Mine also generated 171,651 t of byproduct magnetite concentrates at a grade of nearly 62% iron and 1.6% titanium dioxide; the concentrates were either sold to the coal-washing industry or stockpiled. Measured, indicated, and inferred mineral resources were reported to be 4.41 Mt of oxide ore at a grade of 0.6% copper and 400,000 t of stockpiled ore at a grade of 0.5% copper. Proved and probable mineral reserves that remained in the open pit were reported to be 2.98 Mt at 0.40% copper, and those in the underground mine, 232 Mt at 0.68% copper. During 2002, Palabora awarded Foskor Limited, which extracted phosphate-bearing rock from the carbonatite ore, 42 Mt of stockpiled sulfide ore in exchange for that part of the underground reserve that is beyond Foskor's boundary (Palabora Mining Company Limited, 2003§).

O'okiep Copper Co. (Pty.) Ltd., which was owned by Metorex, operated a copper mine at Nigramoep and a copper smelter at Nababeep in the Northern Cape Province. For the financial year that ended on June 30, 2003, O'okiep milled 180,000 t of ore at an average head grade of 1.49% copper and 1.14 Mt of slag at a grade of 1.1% copper. With a 95% smelter recovery rate, blister copper production was 10,000 t, which included production from copper concentrates from Metorex's Maranda Mine in South Africa and Chibuluma Mine in Zambia (Metorex Ltd., 2003b§).

An additional 20,000 t/yr of copper was produced as a byproduct of platinum refining, and from 6,000 to 7,000 t/yr of additional copper, from lead-zinc and nickel mining operations.

Gold.—After a more-than 30-year progressive decline in gold production from the historical peak production of 989 t in 1970 to 395 t of gold in 2001, gold production in South Africa began to turn around in 2002 when production increased to 398.3 t of gold. It appeared ready for a reversal of this downward trend. With three new large gold mine projects, which represented a combined capital investment of more than \$1.6 billion, coming onstream during 2002 and 2003, about 30 t/yr of new gold production capacity will be in place by 2003, and an additional 25 t/yr, by 2007. Avgold Ltd. (a subsidiary of Anglovaal Mining Ltd.) expected to start production of its Target Mine in 2002 at a rate of 4,900 kilograms per year (kg/yr) of gold and to increase to full production of 15,500 kg/yr of gold by 2007. Western Areas Ltd.'s South Deep Mine, which was a 50-50 joint venture between JCI Gold Ltd. and Placer Dome, Inc. of Canada, produced at a one-half capacity rate of 12,500 kg/yr in 2001; it will be at full production of 23,300 kg/yr by 2007. The third major project, AngloGold Ltd.'s Moab Khotsong Mine, will start production in 2003 at a rate of 12,000 kg/yr of gold and will increase to 16,600 kg/yr of gold by 2007. In addition, Harmony Gold Mining Co. Ltd. announced plans to develop its Doornkop South Reef Mine at a cost of \$120 million.

In 2002, the gold industry employed 199,300 people; as much as one-third of the workforce was infected with HIV, which added to increased labor costs and prompted several of the companies to support antiretroviral treatment for employees. With a 14% increase in the dollar gold price, the value of gold

sales in rand terms increased by 42.7% in 2002 to R41.4 billion (Mining Journal, 2003; Department of Minerals and Energy, 2003b§).

Iron Ore.—In November 2001, Iscor Ltd. completed its unbundling of assets but retained its iron and steel operations and spun off all its base-metals, coal, industrial minerals, iron ore, and titanium mining operations into a new company, Kumba Resources Ltd. Iscor retained a 75% interest in Kumba; the Industrial Development Corporation of South Africa acquired 23.5%. Kumba Resources began operating on January 1, 2002 (Kumba Resources Ltd., 2003§). In March 2002, Anglo American plc acquired a 20% interest in Kumba Resources.

In 2002, iron ore production in South Africa increased by 5% to 36.48 Mt, gross weight, which contained about 23.2 Mt of iron. Of total sales of iron ore, which were valued at about \$488 million, 67% was exported, and 33% was shipped to domestic steel plants. Kumba Resources was South Africa's leading iron ore producer in 2002. Its two iron mines, Sishen and Thabazimbi, on a contained iron basis, accounted for about 78% of the country's total output. For the financial year that ended on June 30, 2003, the Sishen Mine, which was located in Northern Cape Province, produced 26.17 Mt/yr, and the Thabazimbi Mine, which was located in Northern Province, produced 2.39 Mt/yr of contained iron. Thabazimbi was a captive mine that supplied lump and fine iron ore to Iscor steel plants at Vanderbijlpark, which is located outside of Johannesburg, and at Newcastle, which is located in northern KwaZulu-Natal Province. Of the iron ore production at Sishen, 80% was railed to Saldanha Bay for export. The \$100 million expansion of the Sishen Mine to 27 Mt/yr should be completed by December 2004; capacity will increase to 38 Mt/yr of iron ore by 2007. Concurrent with the expansion of the operation, the rail and port infrastructure associated with the Sishen-Saldanha exports will also be upgraded. Thabazimbi had a remaining mine life of between 6 and 8 years. A prefeasibility study on replacing this production by developing the Sishen South (Welgevonden) deposit was being conducted. Sishen South, which is located 70 kilometers (km) south of Sishen, contains a high-quality (64.8% iron) resource of 259 Mt of iron ore suitable for open pit mining (Kumba Resources Ltd., 2003§).

For the financial year that ended on June 30, 2003, Assmang produced 5.26 Mt of iron ore from its operations at the Beeshoek Mine compared with 4.77 Mt of iron ore in the 2002 financial year (Assmang Ltd., 2003b§).

Iron and Steel.—In 2002, South African crude steel production increased by 3% to 9.1 Mt, and stainless steel production, by 25% to 550,000 t. Iscor was the main producer and accounted for 7.12 Mt/yr of steel products for its financial year that ended on June 30, 2003, of which 35% were exported. Iscor will change to calendar-year reporting in December 2003. Domestic sales remained flat during early 2003, but the company expected demand to rise following the lowering of interest rates by The Reserve Bank of South Africa in June 2003. Iscor's accessible import volumes were limited, and the company faced antidumping duties on hot-rolled coil in Canada, the European Union, and the United States, which

resulted in a shift in exports to other markets. The company planned to increase its sales, particularly in Africa. Iscor steel operations were set up into two business units. Its flat steel products division operated steel plants at Saldanha Bay and Vanderbijlpark; the latter had sales of 3.05 Mt/yr of steel in the financial year that ended on June 30, 2003. The Saldanha Steel (Pty.) Ltd. steel plant at Vredenburg, which was located near Saldanha Bay, operated at a profit for the financial year that ended on June 30, 2003, as production increased by 24% to 1.16 Mt of hot-rolled coil steel following repair of the Corex unit in early 2002. Iscor's long steel products division operated the integrated steel works at Newcastle in Kwa-Zulu Natal Province and the EAF-based steel works at Vereeniging in Gauteng Province; they accounted for total sales of 1.83 Mt/yr of steel (Iscor Ltd., 2003§).

Effective January 2002, Acerinox, SA (Spain) acquired a 64% controlling interest in Columbus Stainless (Pty.) Ltd. for \$230 million, with Highveld Steel and Vanadium Corp. Ltd., Industrial Development Corporation of South Africa Ltd., and BHP Billiton retaining 12% each. Acerinox planned to invest nearly \$100 million to upgrade the facility during 2003-04; this included installation of a third cold-rolling mill. During 2002, Columbus produced 550,008 t of stainless steel in its meltshop, 540,949 t of hot-rolled products, and 234,860 t of cold-rolled products (Acerinox, SA, 2003§).

Highveld produced 951,921 t of crude carbon steel in calendar year 2002 compared with 935,760 t in 2001 from its plant at Witbank in Mpumalanga Province (Highveld Steel and Vanadium Corp. Ltd., 2003§).

Lead and Zinc.—Anglo American operated the Black Mountain Mine near Aggeneys in Northern Cape Province. During 2002, Black Mountain treated 1.55 Mt of ore at a grade of 2.6% zinc, 3.5% lead, and 0.5% copper that yielded 45,300 t of lead, 27,600 t of zinc, and 5,400 t of copper. Ore reserves at Black Mountain were recalculated for yearend 2001 at a 56% higher tonnage and lower average grades as 12.7 Mt at a grade of 0.54% copper, 3.05% lead, and 1.78% zinc plus measured and indicated mineral resources estimated to be 3.2 Mt at a grade of 0.54% copper, 2.8% lead, and 1.01% zinc. The \$110 million mine expansion was expected to be completed during 2004. Black Mountain had a remaining mine life of 13 years (Anglo American plc, 2002).

Maranda Mining Co. (Pty.) Ltd., which was owned by Metorex, operated the Maranda zinc-copper mine in the southwestern portion of the Murchison Greenstone Belt in Northern Province. For the financial year that ended on June 30, 2003, Maranda milled at rate of 8,000 t/mo of ore at a head grade of 2.0% copper and 13.5% zinc. Production of metal contained in concentrates for the year was reported to be 1,300 t of copper and 9,000 t of zinc. As of June 30, 2003, proved and probable reserves were estimated to be 112,260 t at a grade of 14.4% zinc and 1.7% copper (Metorex Ltd., 2003c§).

Production at BHP Billiton's Pering zinc/lead mine ended in February 2003. For its final financial year that ended on June 30, 2003, however, the operation produced 17,096 t of zinc and 2,615 t of lead compared with 21,115 t of zinc and 4,302 t of lead during the previous financial year (BHP Billiton Plc, 2003§).

Manganese.—South Africa dominated the world manganese market as the largest producer of manganese and with approximately 80% of the world's reserve base of manganese ore. In 2002, production declined to 3.32 Mt, gross weight, of manganese ore and concentrates compared with 3.63 Mt in 2000; these were primarily metallurgical grades that ranged from 30% to more than 48% manganese. For the financial year that ended on June 30, 2003, BHP Billiton's Samancor Manganese Division produced 2.25 Mt of ore from its Mamatwan open pit and Wessels underground mines near Hotazel, which was an increase of 20% compared with the previous year, and 503,000 t of manganese alloys, which was an increase of 24%. About 40% of the Samancor Manganese Division's manganese ore production was exported to ferroalloy producers worldwide. The remainder was converted into alloys at its plant at Meyerton in Gauteng Province and into manganese metal by Manganese Metal Co. Pty. Ltd. The Samancor Manganese Division, in turn, exported 85% of its production (BHP Billiton Plc, 2003§).

Assmang operated the Gloria and the Nchwaning underground manganese mines in Northern Cape Province. Assmang was investing \$75 million to add a new 2,200-meter (m)-deep shaft complex at the Nchwaning III Mine, which was expected to be operational by late 2003. The expanded Nchwaning operation will have a run-of-mine capacity of about 2 Mt/yr of manganese, which could extend its mine life by more than 20 years. For the financial year that ended on June 30, 2003, Assmang sales included 1.17 Mt of manganese ore compared with 999,000 Mt in 2002 and 206,000 t of manganese alloys compared with 190,000 t in 2002. Ferromanganese production comes from Assmang plants at Cato Ridge near Durban and Machadadorp near Middleburg. Also during the year, Assmang dissolved its subsidiary company, Ferroalloys Ltd., and brought its Cato Ridge ferromanganese plant in-house (Assmang Ltd., 2003§).

Highveld produced 170,099 t of medium carbon manganese and silicomanganese alloys in calendar year 2002 compared with 154,159 t in 2001 at its Transalloys Division at Witbank. Ferrosilicon production increased by 9% to 59,049 t (Highveld Steel and Vanadium Corp. Ltd., 2003§).

Nickel.—South Africa's nickel production was in the form of metal, metal-in-concentrate, and sulfate. About 88% of nickel production comes as a byproduct of PGM processing, nearly 250 t as nickel sulfate from the Palabora copper mine, and the remainder as primary production from the Nkomati nickel mine. In 2002, mine production increased by 6% to 38,500 t from 36,400 t in 2001. Domestic sales of refined nickel, primarily to the stainless steel plants, amounted to about \$151 million; export sales of nickel were valued at more than \$101 million. Nickel production was expected to expand between 2000 and 2007 as the platinum industry undergoes a 67% expansion and if the Nkomati joint venture, which was controlled by Anglovaal Minerals Ltd. (Avmin) (75%), proceeds with its proposed expansion. A proportional increase in byproduct nickel production from the expansion of the PGM industry was not expected, however, because much of the new platinum production will come from the UG2 chromititic seams, which have a lower nickel content than the other reefs currently being mined for PGMs (Department of Minerals and Energy, 2003b§).

During 2002, the Nkomati joint venture milled 302,000 t of ore with a head grade of 2.38% nickel that produced 55,300 t of concentrate with an average nickel grade of 9.96%. This resulted in a 25% increase of final metal production levels to 4,900 t of nickel and economically important byproduct production of copper (3,300 t), cobalt (62 t), and PGMs (1,213 kg). Additional in-fill drilling was being done in 2003 prior to making a final decision to proceed with development of the high-grade massive sulfide ore body and to begin the underground and surface development of the lower grade main mineralized zone. The proposed \$200 million project would increase production to 17,500 t/yr of nickel, 9,000 t of copper, 800 t of cobalt, and 2,488 kg of PGM (Anglovaal Mining Ltd. 2003§).

Platinum-Group Metals.—Reflecting new investments in the sector, PGM production increased to 239,351 kg in 2002, which was a 16% increase from that of 2000; 2002 PGM exports were valued at \$3.33 billion. Production was 133,796 kg of platinum, 64,244 kg of palladium, 22,094 kg of ruthenium, 15,367 kg of rhodium, and 3,950 kg of other platinum-group elements. The PGM industry employed more than 111,000 workers in 2002. The main refined PGM producers were, in descending size, Anglo American Platinum Corp. Ltd. (Anglo Platinum), Impala Platinum Holdings Limited (Implats), Lonmin plc., and Northam Platinum Ltd. Reported industry investment plans indicated that between 2000 and 2007, more than \$3.5 billion was projected to be spent in South Africa to add almost 99,000 kg (3.17 million ounces) in new capacity that will bring total PGM production capacity to 246,000 kg (7.92 million ounces). This included \$2 billion by Anglo Platinum, which was the largest PGM producer in the world at about 37% of global platinum supply, to expand capacity by 75% to 108,860 kg/yr of PGM; \$780 million by Implats, which was the second largest producer in South Africa, to expand capacity by 34% to 76,510 kg/yr of PGM; \$550 million by Lonmin to expand capacity by 45% to 27,060 kg/yr of PGM; \$64 million by Northam, which was majority controlled by the black empowerment company, Mvelaphanda Platinum Ltd., to increase capacity by 31% to 13,060 kg/yr of PGM; and several greenfield developments by Aquarius Platinum Ltd. of Australia, Messina Ltd., SouthernEra Resources Ltd. of Canada, and Two Rivers Platinum (Pty.) Ltd., which will add another 19,000 to 20,000 kg/yr of PGM by 2007. Other BEE companies that participated as joint-venture or minority interest partners in the expansion of the PGM sector included African Rainbow on the Twickenham (Maandagshoek) Project, the Royal Bafokeng Nation on the Bafokeng Rasimone platinum mine project, TISO Capital (Pty.) Ltd. on the Dwarsrivier Farm Project, and the Bapo Ba Mogale tribe on the proposed Pandora Project.

Titanium and Zirconium.—Globally, South Africa ranked second in titanium production and fifth in titanium exports in 2002. Richards Bay Minerals (owned jointly by Rio Tinto and BHP Billiton) produced ilmenite, rutile, and zircon from beach sands north of Richards Bay. Richards Bay Minerals was the trading name for two registered companies—Richards Bay Iron and Titanium (Pty.) Ltd. (RBIT) and Tisand (Pty.) Ltd. Tisand was responsible for the dune mining operation

and mineral separation. RBIT, which was responsible for the smelting and beneficiation process, produced an 85% titanium dioxide slag and low-manganese pig iron from ilmenite concentrates at the Richards Bay smelter. The flow sheet for the operation was available on the company Web site accessible at URL <http://www.richardsbayminerals.co.za>. The Richards Bay operation was the largest titanium mineral producer in the country and held the rights to more than 1 billion metric tons of heavy-mineral sands reserves, which was sufficient to maintain mining for approximately 20 more years. In response to weak international markets, production was cut back by about 11% for calendar year 2002 to an estimated 790,000 t of titanium slag, 190 t of zircon, and 80 t of rutile (BHP Billiton Plc, 2003).

Namakwa Sands Limited operated a heavy-mineral sand mine at Brand-se-Baai; a mineral separation plant at Koekenapp, which is located 340 km northwest of Cape Town; and a smelter at Vredenburg, which is located near the export harbor at Saldanha Bay. During 2002, Namakwa Sands mined 16.4 Mt of ore to yield 315,900 t of ilmenite concentrates, 112,400 t of zircon concentrates, and 26,000 t of rutile concentrates. Smelter production of titanium slag increased by 8% to 162,700 t, and that of pig iron, by 11% to 103,000 t. By using a new cut-off grade methodology and a new geologic model, reserves were reduced by about 130 Mt. Remaining proven and probable reserves at Namakwa Sands at yearend 2002 were 409 Mt at a grade of 3.6% ilmenite, 1.0% zircon, and 0.2% rutile. In addition, measured plus indicated resources were reported to be 177 Mt at a grade of 3.3% ilmenite, 0.8% zircon, and 0.2% rutile (Anglo American plc, 2003§).

The Tigor Heavy Minerals Project, which was a joint venture between Kumba Resources (60%) and Tigor Ltd. of Australia (40%), included the Hillendale heavy-minerals mine and Minerals Separation Plant and a titanium slag smelter at Empangeni located near the Richards Bay deepsea port in KwaZulu-Natal Province. A second mine at Fairbreeze and the smelter's second furnace were planned for 2005. Kumba Resources also held a controlling 50.12% interest in Tigor, which gave it an effective 80% control of the project. During its first full year of operation for the financial year that ended on June 30, 2003, Tigor produced 480,000 t of ilmenite, 250,000 t of titanium slag, 179,000 t of synthetic rutile, 145,000 t of pig iron, 94,000 t of pigment 80,000 t of zircon, 36,000 t of rutile, and 26,000 t of leucoxene. Ilmenite was being stockpiled as feedstock for the first smelter furnace, which was commissioned in March 2003 (Kumba Resources Ltd., 2003§).

Palabora also recovered titaniferous magnetite from the Phalaborwa carbonatite as a byproduct of copper and phosphate rock production; and Highveld generated titaniferous slag at the Witbank steel plant from magnetite ores from its Mapoch Mine.

Zirconium was produced as a zircon byproduct of mining at the Richards Bay Minerals and the Namakwa Sands mineral sands operations. During 2001, Palabora permanently closed its heavy minerals plant, which produced zirconium dioxide and calcined uranium oxide. Following closure of the open pit copper mine in April 2002, the baddeleyite plant was closed; the remaining 193 t of stockpiled baddeleyite was sold. Palabora concentrated its efforts to upgrade its new zirconium basic sulphate (ZBS) plant to make more value-added zirconia products. A fire at the ZBS plant delayed opening of

the expanded plant from January to April 2002. During 2002, Palabora produced 501 t of ZBS (Palabora Mining Company Limited, 2003§).

Vanadium.—South Africa was the world's leading producer and exporter of vanadium. Vanadium was produced from titaniferous magnetite that was mined from the Bushveld Complex. The largest producer was Highveld. From calendar years 2001 to 2002, Highveld's production of vanadium slag increased by 1% to 74,395 t, and that of ferrosilicon, by 9% to 59,049 t (Highveld Steel and Vanadium Corp. Ltd., 2003§).

Xstrata South Africa (Pty.) Ltd. was the second largest South African producer of vanadium through its holdings in Rhombus Vanadium Holdings Ltd. and Vanadium Technology (Pty.) Ltd. In 2002, Xstrata increased production of vanadium pentoxide at its Australian and South African vanadium operations by 6% to 18,748 t, and that of ferrovandium, by 5.5% to 6,458 t. In 2002, the U.S. Department of Commerce, International Trade Administration, charged Xstrata's alloys division and Highveld with dumping ferrovandium products into U.S. markets at less than fair value and effectively levied an antidumping duty of 116% on ferrovandium sales to the United States by Xstrata and Highveld Steel (Xstrata plc, 2003§).

Industrial Minerals

South Africa produced more than 30 different industrial minerals from more than 500 mines and quarries, about one-half of which was devoted to aggregate and sand production. The industrial minerals sector employed more than 14,900 workers and contributed about 4% of total mineral sales. In 2002, the value of total sales of industrial minerals produced was reported to be \$515.9 million, of which 71% of sales was to the domestic market. In terms of sales, the three dominant industrial mineral commodities were aggregate and sand (\$93.6 million), limestone and dolomite (\$100.5 million), and vermiculite (\$20 million). The largest domestic consumers of South Africa's industrial minerals were the building and construction, metallurgical, and agricultural sectors. Granite and norite dimension stone accounted for 51% of industrial mineral exports of \$148.3 million; the other major export commodities were, in order of declining value, vermiculite, phosphate rock, andalusite, and asbestos. South Africa accounted for 40% of the world's supply of vermiculite, 37% of aluminosilicates (andalusite), and more than 6% each of fluor spar and granite (Department of Minerals and Energy, 2003§).

Diamond.—Rough diamond production decreased by 2% in 2002 to 10.9 million carats. As in years past, mines owned by De Beers Consolidated Mines Ltd. dominated the sector with about 95% of the total production. The South Africa Diamond Board estimated that an additional 260,000 carats of diamond was produced by small-scale diggers during 2002. Total diamond production for De Beers' South African operations in 2002 amounted to 10.4 million carats recovered from 24.45 Mt of material treated. De Beers production came from six kimberlite mines and one alluvial mine in Namaqualand. Production came from the Venetia Mine (5,077,042 carats), the Finsch Mine (2,378,243 carats), the Premier Mine (1,471,754

carats), the Namaqualand Mine (773,768 carats), the Kimberley Mine (473,975 carats), the Oaks Mine (115,234 carats), and the Koffiefontein Mine (112,265 carats). Plans to develop the "Centenary Cut" at De Beers' Premier Mine were still under review into 2003. If approved, then the estimated \$660 million project would more than double production at the Premier Mine to 9 Mt/yr of ore from its 2002 capacity of 4 Mt/yr. A mechanized block caving mining method would be used to extend the depth of the mine from the 730-m level to the 1,100-m level. An investment decision was expected in 2003 (Department of Minerals and Energy, 2003b§; De Beers Group, 2002b§). Other significant diamond-producing companies included Trans Hex Group Ltd. from its operations in northwestern South Africa, SouthernEra from its new Klipspringer Mine in Limpopo Province, and Alexkor Limited in North West Cape Province.

In November 2002, about 50 countries that produced, traded, and processed diamond became signatories to the Kimberley Process Certification System aimed at establishing a system of certificates of origin to control the global trade in diamond. The treaty resulted from international concern over the growing evidence of illegally mined and exported diamond revenues being used to support civil conflicts in Angola, Sierra Leone, and elsewhere (Kimberley Process Secretariat, 2003§).

Fluorspar.—The world's third leading producer after China and Mexico, South Africa produced 267,000 t of fluorspar during 2002. Output was distributed among Vergenoeg Mining Company (Pty.) Ltd., which was owned by Metorex; Witkop Fluorspar Mine (Pty.) Ltd., which was owned by the Australian company South Africa Land & Exploration Company; and the Buffalo fluorspar mine, which was reopened by International Metal Processing of South Africa in 2000 and then temporarily shut down in August 2002 owing to legal problems.

The open pit Vergenoeg Mine, which was located 70 km north-northwest of Pretoria, milled 38,000 t/mo of ore at a head grade of 36.5% calcium fluoride. Annual production was 18,000 t of metallurgical-grade fluorspar and 120,000 t of acid-grade fluorspar. As of June 30, 2002, mineral reserves were reported to be 6 Mt at a grade of 36.9% calcium fluoride (CaF₂) plus mineral resources of 217 Mt at a grade of 23.4% CaF₂ (Metorex Ltd., 2003d§).

The annual capacity of the Witkop operation from four quarries and a flotation plant was 140,000 t of acid-grade fluorspar. During 2002, the company was studying the feasibility of doubling capacity to 180,000 t/yr.

Vermiculite.—The major producer was the Vermiculite Operations Division of Palabora, which extracted vermiculite from the pyroxenite units of the mineralogically diverse Phalaborwa Carbonatite Complex. In 2002, Palabora treated 2.27 Mt of ore to yield 224,258 t of vermiculite concentrates at a grade of 90.1% vermiculite compared with 166,078 t of vermiculite concentrates in 2001. The record production for 2002 was attributed to the increase in plant recovery to 56% from 48%. Palabora accounted for 40% of the world's supply of vermiculite. The company reported vermiculite resource estimates of 97 Mt of measured, indicated, and inferred resources at an average grade of 27.9% vermiculite at yearend

2002; proved and probable reserves were 43.8 Mt at an average grade of 32.3% vermiculite. Common to other industrial minerals, approximately 70% of Palabora's delivered costs of vermiculite to markets in Asia and Europe were in logistics and transport (Palabora Mining Company Limited, 2003§).

Mineral Fuels

Coal.—Following platinum and gold, coal was one of the most important sectors of the mineral economy of South Africa. During 2002, 54 coal mines employed more than 43,000 workers. South Africa remained the fifth leading coal-producing country in the world and the third leading coal exporter. According to the South Africa Mineral Economics Directorate, in 2002, production dropped 1% to 220.2 Mt of salable coal valued at \$2.98 billion; of this total, 69.2 Mt, which was valued at \$1.85 billion, was exported primarily through the Richards Bay Coal Terminal (RBCT). About one-half of production came from open cast operations. The RBCT had a steam-coal-exporting capacity of 72 Mt/yr with plans to expand the capacity to 81 Mt/yr by 2007; although as of early 2003, the development agreement between RBCT and the National Ports Authority had yet to be signed. More than 88% of salable coal production was controlled by Ingwe Coal Corp. Ltd. (26%), which was controlled by BHP Billiton Plc, Sasol Mining (Pty.) Ltd. (22%); Anglo American Coal Corp. Ltd. (21%); Kumba Resources (10%); and Eyesizwe Coal (9%). In 2001, 157.6 Mt of coal was consumed domestically. The majority of domestic sales went to electricity (92.4 Mt), synthetic fuels production (50.6 Mt), and industry (12.8 Mt). A reassessment of South Africa's coal reserves by the Department of Minerals and Energy was expected during 2004. Approximately 12 new coal projects were under development or in planning during calendar year 2002-03 that could increase coal production by 10% to 15% by financial year 2005-06 (Department of Minerals and Energy, 2003b§).

Petroleum and Natural Gas.—Details on South Africa's energy and fuels industries are available at U.S. Energy Information Administration (2003§).

Reserves

South Africa's mineral reserves are large and varied and reflect the country's complex geology. A detailed description of the geology and mineral resources of South Africa was updated by the Council for Geosciences in 1998 (Wilson and Anhaeusser, 1998). The bulk of South Africa's mineral production is from the northern one-half of the country. Table 3 lists the reserve base for a number of South Africa's major minerals. Although data for many of the minerals listed are incomplete for the world, South Africa's reserves appear to rank among the top five countries and would rank first in the world for andalusite, chromite, gold, manganese, PGM, and vanadium.

Infrastructure

The country has a well-developed and extensive road and railroad infrastructure that served not only South Africa, but also

the neighboring countries of southern Africa. Roadways totaled 358,600 km, of which approximately 61,000 km was paved. Railroad infrastructure totaled 20,400 km, of which 9,087 km was electrified. Portnet, which was the state-owned port authority, maintained the largest and most efficient commodity export harbors in Sub-Saharan Africa, most of which handled minerals, notably Cape Town, Durban, East London, Mossel Bay, Port Elizabeth, Richards Bay, and Saldanha Bay. In addition to fulfilling the requirements of South Africa itself, the country's ports also served as outlets for such landlocked countries as Botswana, Lesotho, Swaziland, Zambia, and Zimbabwe. South Africa was also a regional supplier of electricity and petroleum products, two of a number of examples of the dependence of neighboring countries on South Africa's infrastructure and transportation networks.

Richards Bay handled more than one-half of the volume of cargo among South African ports. The RBCT had a coal export capacity of about 72 Mt/yr out of the total bulk cargo port capacity of 75 Mt/yr at Richards Bay. A second coal export facility was being built at South Dunes near Richards Bay to handle an additional 12 Mt/yr of coal exports. Coal exports through Durban and the Mozambican port of Maputo were only a fraction of those through the RBCT. Durban's port facilities were designed mainly for small consignments of high-quality lump bituminous and anthracite coals that cannot be properly handled at Richards Bay.

Eskom had a nominal capacity of 41,298 megawatts predominantly from coal-fired sources and a small percentage of electricity that was generated from nuclear sources. The company operated more than 306,100 km of power lines (Eskom, 2001§). South Africa also maintained 1,748 km of pipeline for the distribution of petroleum products; 931 km of pipeline for crude oil; and 322 km of pipeline for natural gas.

Outlook

South Africa is endowed with one of the richest and most diverse concentrations of mineral resources on Earth and has, in terms of size and value, one of the top 10 mining and mineral-processing industries in the world. Contributing to more than 25% of the country's GDP, the minerals sector is expected to continue to play an important role in the economy for many years to come. The Government is balancing the needs to focus policy initiatives and budget resources on redressing social and economic inequities in the country with the need to maintain economic and labor policies that allow South African exports to remain competitive in global markets. As a sign of confidence in the future of South Africa, domestic and foreign mineral investors have announced plans to commit more than \$10 billion to develop or expand new mining and value-added mineral-processing capacity between 2000 and 2007. These planned investments are, however, subject to internal and external forces that could delay or constrict actual implementation. Internally, the impact of the high rate of HIV/AIDS in the country on the able-bodied skilled and semiskilled workforce between 15 and 49 and on the resulting increasing direct and indirect labor costs to industry are of concern to investors. Some investment may be reevaluated depending on the outcome of the ongoing debate on the direction of mineral policy, which includes

local ownership, mineral rights, and taxation. South Africa is moving aggressively to promote black economic empowerment and participation in the minerals sector but will face some constraints in meeting goals owing to limited access to capital and to the lead time needed to develop competitive business, scientific, and technical skills within the black South African workforce.

Externally, the global economy has been showing positive signs of growth, particularly in China. This is leading to an increasing demand for metals, in particular, and is likely to stimulate increased investment in mineral exploration and development through the first decade of this century, particularly in countries like South Africa, which have a rich, known mineral resource endowment. Increased attention was being given to environmental issues, which are also factors in projects that require financing from international lending institutions. The appreciation of the rand against the dollar began to create problems for the industry during 2002 and early 2003. A further appreciation below R6 to the U.S. dollar could put additional pressure on companies to meet internal costs in rands. These factors will influence the way that the South African Government maintains the investment policies and economic incentives that will determine how South Africa competes for investment with the other major mineral-export-oriented countries, such as Australia and Canada, and on how mining companies perceive the economic and political investment climate in South Africa for several years to come.

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 - D14/2002 Producers of sand and aggregate
- Mineral Production and Sales Statistics, monthly.

TABLE 1
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES ¹

(Metric tons unless otherwise specified)

| Commodity | 1998 | 1999 | 2000 | 2001 | 2002 | |
|---|---------------|---------------------|----------------------|----------------------|---------------------|---------|
| METALS | | | | | | |
| Aluminum metal, primary | 677,000 | 689,230 | 673,486 ^r | 662,497 | 706,916 | |
| Antimony concentrate: | | | | | | |
| Gross weight | 7,316 | 9,100 | 6,400 ^r | 8,320 ^r | 9,910 | |
| Sb content (58% Sb) | 4,243 | 5,278 | 3,710 | 4,927 | 5,746 | |
| Chromite, gross weight: | | | | | | |
| 44% to 48% chromic oxide | thousand tons | 2,329 | 2,447 | 2,261 | 2,180 | 2,459 |
| Less than 44% chromic oxide | do. | 4,151 | 4,370 | 4,360 | 3,322 | 3,977 |
| Total | do. | 6,480 | 6,817 | 6,621 | 5,502 | 6,436 |
| Cobalt: | | | | | | |
| Mine output, Co content ^c | 435 | 450 | 580 | 550 | 540 | |
| Refinery output: | 296 | 306 | 397 | 371 ^r | 366 | |
| Copper: | | | | | | |
| Mine (company output), Cu content | 164,000 | 144,263 | 137,092 | 141,865 | 129,589 | |
| Metal: | | | | | | |
| Smelter | 152,300 | 149,300 | 172,800 | 142,500 | 119,667 | |
| Refined, primary | 125,600 | 134,500 | 126,100 | 132,078 | 101,000 | |
| Gold, primary | kilograms | 465,100 | 451,300 | 430,800 ^r | 394,800 | 398,300 |
| Iron and steel: | | | | | | |
| Ore and concentrate: | | | | | | |
| Gross weight | thousand tons | 32,965 | 29,512 | 33,707 | 34,757 | 36,484 |
| Fe content (62%-65%) | do. | 20,438 | 18,442 | 21,570 | 22,240 ^r | 23,200 |
| Metal: | | | | | | |
| Pig iron | do. | 5,650 | 4,587 | 6,300 | 5,800 | 5,800 |
| Direct-reduced iron | do. | 1,070 | 1,260 | 1,530 | 1,560 | 1,700 |
| Ferroalloys, electric arc furnace: | | | | | | |
| Chromium ferroalloys | do. | 2,025 | 2,155 | 2,674 ^r | 2,141 | 2,351 |
| Ferromanganese | do. | 542 | 527 | 597 | 524 ^r | 619 |
| Ferrosilicon | do. | 108 | 106 | 109 ^r | 108 ^r | 142 |
| Ferrovandium ^c | do. | 6 | 6 | 18 ^r | 18 ^r | 25 |
| Silicomanganese ^e | do. | 265 | 267 | 238 ^r | 220 ^r | 273 |
| Silicon metal | do. | 33 | 36 | 41 ^r | 39 | 43 |
| Other | do. | 32 | 30 | 30 | 64 | 85 |
| Total ferroalloys | do. | 3,011 | 3,127 | 3,707 | 3,114 | 3,538 |
| Steel: | | | | | | |
| Crude | do. | 7,679 | 6,830 ^r | 8,481 | 8,821 | 9,100 |
| Stainless | | 430 | 450 ^{r, e} | 436 | 440 | 550 |
| Lead: | | | | | | |
| Concentrate, Pb content | 84,128 | 80,191 | 75,262 ^r | 50,771 | 49,444 | |
| Smelter, secondary | 50,000 | 55,000 | 46,200 ^r | 53,000 ^r | 50,000 ^e | |
| Manganese: | | | | | | |
| Ore and concentrate, gross weight: | | | | | | |
| Metallurgical: | | | | | | |
| More than 48% manganese | thousand tons | 1,734 | 1,876 | 2,047 | 2,082 | 1,600 |
| 45% to 48% manganese | do. | 12 | 12 | 302 | -- | 728 |
| 40% to 45% manganese | do. | 218 | 235 | 235 | 326 | 19 |
| 30% to 40% manganese | do. | 1,049 | 970 | 1,029 | 832 | 955 |
| Total | do. | 3,013 | 3,093 | 3,613 | 3,240 | 3,302 |
| Chemical, 35% to 65% manganese dioxide | do. | 31 | 29 | 22 | 26 | 20 |
| Grand total | do. | 3,044 | 3,122 | 3,635 | 3,266 | 3,322 |
| Metal, electrolytic ^c | do. | 40 | 40 | 40 | 40 | 40 |
| Nickel: | | | | | | |
| Mine output, concentrate, nickel content ^c | 36,679 | 36,200 | 36,616 | 36,443 | 38,500 | |
| Metal, electrolytic | 29,039 | 28,345 ^r | 30,900 | 30,500 ^e | 23,700 | |

See footnotes at end of table.

TABLE 1--Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES ¹

(Metric tons unless otherwise specified)

| Commodity | | 1998 | 1999 | 2000 | 2001 | 2002 ^p |
|---|-----------------|----------------------|------------------------|------------------------|------------------------|-------------------|
| METALS--Continued | | | | | | |
| Platinum-group metals: | | | | | | |
| Platinum | kilograms | 116,483 | 121,304 | 114,459 | 130,307 ^r | 133,796 |
| Palladium | do. | 56,608 | 58,164 | 55,818 | 62,601 ^r | 64,244 |
| Rhodium | do. | 11,633 | 12,752 | 12,067 | 13,507 ^r | 15,367 |
| Ruthenium | do. | NA | NA | 19,427 | 19,329 | 22,094 |
| Other ² | do. | 15,419 | 24,259 | 4,999 ^r | 4,169 ^r | 3,850 |
| Total | do. | 200,143 | 216,479 | 206,770 ^r | 229,913 ^r | 239,351 |
| Silver | do. | 144,482 | 151,959 | 144,143 | 109,570 | 113,266 |
| Titanium: ^c | | | | | | |
| Ilmenite concentrate | thousand tons | 2,300 | 1,851 | 1,800 | 1,750 | 1,800 |
| Rutile concentrate | do. | 130 | 100 | 130 | 120 | 120 |
| Total | do. | 2,430 | 1,951 | 1,930 | 1,870 | 1,920 |
| Titaniferous slag ³ | do. | 1,100 | 1,168 | 1,057 | 1,090 ^r | 1,150 |
| Uranium oxide | | 1,138 | 1,084 | 1,015 | 1,065 | 998 |
| Vanadium, vanadium metal content | | 18,954 ^r | 17,612 | 18,021 | 18,184 | 25,227 |
| Zinc: | | | | | | |
| Concentrate: | | | | | | |
| Gross weight | | 129,000 ^c | 129,200 | 116,100 | 113,400 | 118,900 |
| Zn content | | 69,630 | 69,733 | 62,703 | 61,221 | 64,173 |
| Metal, smelter, primary | | 107,400 | 108,000 | 103,000 | 109,000 | 105,000 |
| Zirconium concentrate (baddeleyite and zircon) ^c | | 265,000 | 219,000 | 253,000 | 245,000 ^r | 274,000 |
| INDUSTRIAL MINERALS | | | | | | |
| Aluminosilicates: | | | | | | |
| Andalusite | | 236,200 | 136,949 | 182,674 | 193,225 | 165,000 |
| Sillimanite | | 65 | -- | -- | -- | -- |
| Asbestos, chrysotile | | 27,195 | 18,700 | 18,782 | 13,393 | -- |
| Barite | | 610 | 2,844 | 1,628 | -- | -- |
| Calcite | | 2,764 | -- ^r | -- ^r | -- ^r | -- |
| Cementitious products: | | | | | | |
| Cement, finished product, sales | thousand tons | 8,738 | 8,068 | 7,971 | 8,036 | 8,525 |
| Granulated slag, fly ash, and others, sales | do. | 843 | 940 | 1,020 | 1,129 | 1,099 |
| Total | do. | 9,581 | 9,008 | 8,991 | 9,165 | 9,624 |
| Clays: | | | | | | |
| Attapulgit | | 7,800 | 7,008 | 10,287 | 9,299 | 7,990 |
| Bentonite | | 48,382 | 49,261 | 85,187 | 116,384 ^r | 218,512 |
| Fire clay | | 143,500 | 119,450 | 112,637 | 141,303 | 101,150 |
| Flint clay, raw and calcined | | 82,787 | 88,864 | 47,256 | 50,848 | 41,963 |
| Kaolin | | 138,300 | 123,173 | 98,897 ^r | 85,556 ^r | 91,380 |
| Brick clay, local sales | thousand tons | 3,518 | 3,289 | 5,347 | 5,823 | 6,203 |
| Diamond, natural: | | | | | | |
| Gem | thousand carats | 4,282 ^r | 4,006 ^r | 4,316 ^r | 4,465 ^r | 4,350 |
| Industrial | do. | 6,423 ^r | 6,009 ^r | 6,474 ^r | 6,698 ^r | 6,526 |
| Total | do. | 10,705 ^r | 10,015 ^r | 10,790 ^r | 11,163 ^r | 10,876 |
| Feldspar | | 56,400 | 59,336 | 66,774 | 66,736 ^r | 57,197 |
| Fluorspar: | | | | | | |
| Acid-grade | | 222,000 | 203,280 | 201,737 | 272,068 | 254,000 |
| Metallurgical-grade | | 15,000 | 14,000 | 10,618 | 14,319 | 13,000 |
| Total | | 237,000 | 217,280 | 212,355 | 286,387 | 267,000 |
| Gemstones, semiprecious: Tiger's eye ^c | kilograms | 87,200 ⁴ | 80,000 | 80,000 | 80,000 | 80,000 |
| Gypsum, crude | | 485,749 | 505,404 | 413,105 | 382,830 | 415,387 |
| Industrial or glass sand (silica) | thousand tons | 2,223 | 2,170 | 2,138 | 2,132 | 2,262 |
| Lime | do. | 1,523 | 1,920 | 1,391 | 1,615 | 1,598 |
| Magnesite, crude | | 74,300 | 74,000 ^{r, e} | 74,000 ^{r, e} | 33,900 ^{r, e} | 40,000 |
| Mica, scrap and ground | | 1,556 | 1,010 | 708 | 937 ^r | 821 |

See footnotes at end of table.

TABLE 1--Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES ¹

(Metric tons unless otherwise specified)

| Commodity | 1998 | 1999 | 2000 | 2001 | 2002 ^P | |
|---|----------------------------|----------------------|----------------------|-----------------------|------------------------|----------------------|
| INDUSTRIAL MINERALS--Continued | | | | | | |
| Nitrogen, N content of ammonia | 722,800 | 784,800 | 560,200 | 505,900 | 491,900 | |
| Perlite ^c | 400 | 400 | 400 | 400 | 400 | |
| Phosphate rock: | | | | | | |
| Gross weight | thousand tons | 2,739 | 2,957 | 2,796 | 2,550 ^r | 2,803 |
| Phosphorus pentoxide content | do. | 1,068 | 1,153 | 1,083 | 995 ^r | 1,086 |
| Pigments, mineral, natural: | | | | | | |
| Ochers | 122 | 118 | 550 | 801 | 143 | |
| Oxides | 64 | 98 | 80 | 51 | 109 | |
| Total | 186 | 216 | 630 | 852 | 252 | |
| Salt | 356,059 | 388,380 | 345,632 | 353,998 ^r | 430,647 | |
| Silica | thousand tons | 2,223 | 2,170 | 2,137 | 2,127 | 2,248 |
| Sodium sulfate, natural | 48,613 | 53,400 | 49,712 | 57,759 | 53,793 | |
| Stone, n.e.s.: | | | | | | |
| Dimension: | | | | | | |
| Granite and norite ⁵ | 669,363 | 782,000 | 648,818 | 716,294 | 765,486 | |
| Slate | 23,547 | 24,500 | 24,952 | 40,984 | 24,386 | |
| Crushed and broken: | | | | | | |
| Limestone and dolomite | thousand tons | 19,754 | 19,030 | 15,881 | 18,764 | 19,922 |
| Nepheline syenite | 11,500 ^e | -- | -- | -- | -- | |
| Quartzite | thousand tons | 10,203 | 8,360 | 7,965 | 7,412 | 318 |
| Shale: | | | | | | |
| For cement | do. | 279 | 286 | 294 | 243 | 275 |
| Other ⁵ | do. | 3,707 | 3 | 7,358 | 67 | 67 |
| Total | do. | 3,986 | 289 | 7,652 | 310 | 342 |
| Aggregate and sand, n.e.s. | do. | 33,803 ^r | 29,326 ^r | 27,836 ^r | 28,459 ^r | 31,516 |
| Sulfur: | | | | | | |
| S content of pyrite (53.45%) | do. | 152 | 141 | 146 | 150 | 183 |
| Byproduct: | | | | | | |
| Metallurgy ^c | do. | 122 | 126 | 100 ^r | 265 | 362 |
| Petroleum | do. | 178 | 139 | 202 ^r | 123 | 137 |
| Total | do. | 452 | 406 | 448 ^r | 538 ^r | 682 |
| Talc and related materials: | | | | | | |
| Talc | 11,328 | 7,873 ^r | 5,600 | 3,030 | 2,511 | |
| Pyrophyllite (wonderstone) | 11,500 | 13,277 | 11,989 | 14,047 ^r | 15,587 | |
| Vermiculite | 221,300 | 217,800 | 208,835 | 156,632 ^r | 210,000 | |
| MINERAL FUELS AND RELATED MATERIALS | | | | | | |
| Coal (saleable product): | | | | | | |
| Anthracite | thousand tons | 2,101 ^r | 1,930 ^r | 1,618 | 1,618 ^r | 1,305 |
| Bituminous | do. | 222,283 | 221,541 | 222,500 | 221,882 ^r | 218,895 |
| Total | do. | 224,384 ^r | 223,471 ^r | 224,118 | 223,500 | 220,200 |
| Natural gas | million cubic meters | 1,560 | 2,039 | 2,088 | 1,800 ^{r,e} | 2,000 ^e |
| Petroleum: ⁶ | | | | | | |
| Crude | thousand 42-gallon barrels | 6,549 | 5,493 | 6,606 | 13,870 | 10,950 |
| Refinery products: | | | | | | |
| Liquefied petroleum gases | do. | 3,650 | 3,650 ^e | 4,000 ^r | 4,000 ^{r,e} | 4,000 ^e |
| Gasoline | do. | 67,525 | 67,000 ^e | 67,900 ^r | 67,900 ^{r,e} | 67,900 ^e |
| Jet fuel | do. | 12,410 | 12,000 ^e | 13,900 ^r | 13,900 ^{r,e} | 13,900 ^e |
| Kerosene | do. | 7,300 | 7,000 ^e | 11,700 ^r | 11,700 ^{r,e} | 11,700 ^e |
| Distillate fuel oil | do. | 55,115 | 55,000 ^e | 51,500 ^r | 51,500 ^{r,e} | 51,500 ^e |
| Residual fuel oil | do. | 24,090 | 24,000 ^e | 34,700 ^r | 34,700 ^{r,e} | 34,700 ^e |
| Other, includes lubricants and greases ^e | do. | 12,400 ^r | 12,400 ^r | 18,250 ^{r,4} | 18,300 ^r | 18,300 |
| Total ⁷ | do. | 182,490 ^r | 181,000 ^e | 201,950 ^r | 202,000 ^{r,e} | 202,000 ^e |

See footnotes at end of table.

TABLE 1--Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES ¹

⁶Estimated; estimated data are rounded to no more than three significant figures; may not add up to totals shown. [†] Revised. NA Not available. -- Zero

¹Table includes data available through December 2003.

²Difference between total production reported by Minerals Bureau and palladium, platinum, and rhodium supplies (shipments) reported in Johnson and Matthey Annual Platinum Review. Includes iridium and ruthenium production plus excess palladium, platinum, and rhodium inventory.

³Except for about 45,000 metric tons per year, slag derived from titaniferous magnetite by Highveld Steel and Vanadium Corp. Ltd., titaniferous slag is all from the smelting of ilmenite and likely represents most of that mineral's production, for which data are unavailable.

⁴Reported figure.

⁵Converted from reported cubic meters by using 1 cubic meter=2.7 tons.

⁶In addition, Sasol Ltd. produced about 67 million barrels per year of synthetic liquid petroleum fuels from coal.

⁷Excludes refinery fuel and losses.

Source: Mineral Economics Directorate, South Africa Department of Minerals and Energy.

TABLE 2
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2002 ¹

(Thousand metric tons unless otherwise specified)

| Commodity | Major operating companies and major equity owners | Location of main facilities | Annual capacity |
|------------|--|---|--|
| Aluminum | BHP Billiton Aluminium South Africa (Pty.) Ltd. (BHP Billiton Plc, 100%) | Bayside smelter at Richards Bay | 184. |
| Do. | do. | Hillside smelter at Richards Bay planned expansion by 2003 | 510 (increases to 640). |
| Andalusite | Rhino Minerals (Pty.) Ltd. [Mircal South Africa (Pty) Ltd., 100%, acquired from Avmin, July 1999] | Rhino Mine near Thabazimbi | 120. |
| Do. | do. | Havercroft Mine at Penge, North of Steelpoort | 60. |
| Do. | Samrec Pty. Ltd. of France (Imerys, 100%) | Annesley Mine at Penge, 50 kilometers north of Steelpoort | 75. |
| Do. | do. | Andalusite Refractories Mine at Groot Marico 60 kilometers west of Rustenburg | 12. |
| Do. | do. | Krugerspost Mine, near Lydenburg | 50. |
| Do. | Hoogenoeg Andalusite (Pty.) Ltd. | Hoogenoeg Mine, 60 kilometers northeast of Potgietersrus | 15. |
| Do. | Andalusite Resources (Pty.) Ltd. (opened mid-2002) [African Mineral Trading and Exploration (Pty.) Ltd.] | Maroeloesfontein, near Thabazimbi, Northern Province | 35 (expandable to 45). |
| Antimony | Consolidated Murchison Ltd. [Metorex Pty. Ltd., 34.3%, Crew Development Corp. (Canada), 3.3%] | Mine, 50 kilometers west of Phalaborwa | 7 antimony concentrate; 1,000 kilograms gold byproduct. |
| Asbestos | Kaapsehoop Asbestos Pty. Ltd. | New Amianthus Mine in Mpumalanga. | NA (chrysotile). |
| Do. | African Chrysotile Asbestos Ltd. | Msauli Mine near Barberton (closed) | NA (chrysotile). |
| Do. | Anglo Dutch Exploration & Mining Co. (Pty.) Ltd. | Stella Mine, east of Barberton (closed) | NA (chrysotile). |
| Do. | Griqualand Exploration and Finance Corp. | Kuruman Mine (closed in 1998) | NA (crocidolite). |
| Cement | Alpha Ltd. [Holcim Ltd. (Switzerland)] | Dudfield kiln near Lichtenburg, also grinding mill at Roodepoort. | 1,830. |
| Do. | do. | Ulco kiln, 60 kilometers northwest of Kimberley | 1,615. |
| Do. | Lafarge South Africa Ltd. [Lafarge (France)] | Lichtenburg kiln, North West Province | 2,500. |
| Do. | do. | Grinding plant near Durban | 200. |
| Do. | Natal Portland Cement Co. (Pty.) Ltd. [Cimentos de Portugal SGPS, S.A. (CIMPOR)] (acquired in November 2002) | Simumu plant, 125 kilometers southwest of Durban; also grinding mills at Durban and Newcastle | 1,500. |
| Do. | Pretoria Portland Cement Co. Ltd. (Bartworld Trust Co. Ltd., 60.3%) | De Hoek, Dwaalboom, Herculese, Jupiter, Slurru, Riebeeck West, and Port Elizabeth kilns | 5,500 (combined), clinker. |
| Chromite | Samancor Ltd. (BHP Billiton Plc, 60%; Anglo American plc, 40%) | Eastern Chrome Mines in Steelpoort Valley, Mpumalanga Province, includes: Steelpoort Mine | 280 salable ore. |
| Do. | do. | Lannex underground | 400 salable ore. |
| Do. | do. | Lannex open pit (opened in 2002) | 120 salable ore. |
| Do. | do. | Tweefontein Mine | 600 salable ore. |
| Do. | do. | Western Chrome Mines in Northern Province includes: Elandsdrift Mine | 428 salable ore. |
| Do. | do. | Mooinooi Mine | 700 salable ore. |
| Do. | do. | Buffelsfontein East Mine | 240 salable ore. |
| Do. | do. | Millsell Mine | 428 salable ore. |
| Do. | Xstrata South Africa (Pty) Ltd. (Xstrata plc, 100%) | Kroondal Mine and Gemini JV Mine east of Rustenburg | 1,320 ore; 880 concentrate. |
| Do. | do. | Wonderkop Mine east of Rustenburg (closed) | 720 ore; 400 concentrate. |
| Do. | do. | Thornecliffe Mine | 1,200 ore. |

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2002 ¹

(Thousand metric tons unless otherwise specified)

| Commodity | Major operating companies and major equity owners | Location of main facilities | Annual capacity |
|-------------------------|--|---|-----------------------------------|
| Chromite-- Continued | Xstrata South Africa (Pty) Ltd. (Xstrata plc, 100%) | Purity Mine, near Rustenburg (closed) | 360 ore; 252 concentrate. |
| Do. | do. | Waterval Mine (startup in 2002), Purity extension | 1,920 ore. |
| Do. | do. | Townlands Mine, adjacent to Waterval (in planning 2002, construction to start in 2003) | 1,320 ore. |
| Do. | do. | Chroombonne Mine, near Rustenburg | 576 ore; 432 concentrate. |
| Do. | HFSA Investments BV (Mitsubishi Corp.), 53.5%; Industrial Development Corp., 25%; ELG Haniel (Germany), 14% (as of the July 2002 merger) | Hernic Chrome Mines: De kroon section, near Brits | 200 lump ore; 500 ROM fines. |
| Do. | do. | Stellite section, near Rustenburg | 60 lump ore; 100 ROM fines. |
| Do. | Bayer (Pty) Ltd. | Rustenburg Chrome Mine | NA. |
| Do. | Lavino South Africa (Pty.) Ltd. (Anglovaal Minerals Ltd., 100%) | Grootboom Mine, near Lydenburg | 500 ore. |
| Do. | Dilokong Chrome Mine (Pty.) Ltd. (Mining Corp. Ltd., 100%) | Dilokong Mine, near Lydenburg | 480 ore. |
| Do. | National Manganese Mines (Pty) Ltd. | Buffelsfontein Mine, Mooinooi, North West Province | 180 ore. |
| Do. | Assmang Ltd. (Anglovaal Minerals Ltd., 50.2%; Assore Ltd., 45.2%) | Dwarsrivier open pit mine (until June 2006) | 600 run-of-mine ore. |
| Do. | do. | Dwarsrivier underground mine (opens 2003-2004) | 1,000 run-of-mine ore. |
| Coal | Anglo Coal Ltd. (Anglo American plc, 100%) | 5 export collieries: Bank, Goedehoop, Greenside, Kleinkopje, and Landau 3 power-generation collieries: Kriel, New Denmark, and New Vaal in Mpumalanga, and KwaZulu Natal Provinces | 52,000 anthracite and bituminous. |
| Do. | Leeuw Mining and Exploration (Pty) Ltd. (acquired Anglo Coal Ltd.'s KwaZulu Natal Province assets in 2002) | Vaalkrantz Mine | 480. |
| Do. | do. | Braakfontein Mine | 980. |
| Do. | Ingwe Collieries Ltd. (BHP Billiton Plc, 100%) | Witbank Coalfield, Mpumalanga Province: Douglas Underground/Open Pit Mines (Xstrata, 16% interest) | 7,100 bituminous. |
| Do. | do. | Khutala Underground Mine | 12,300 bituminous. |
| Do. | do. | Koornfontein Underground/Open Pit Mines | 6,000 bituminous. |
| Do. | do. | Middleburg Open Pit Mine (Xstrata, 16% interest) | 14,200 bituminous. |
| Do. | do. | Optimum Open Pit Mine | 13,100 bituminous. |
| Do. | do. | Reitspruit Underground/Open Pit Mines (depleted and closed May 2002) | NA. |
| Do. | Zululand Anthracite Colliery (BHP Billiton Plc, 100%) | Zululand Mine, KwaZulu Natal Province | 500 anthracite. |
| Do. | Xstrata Coal South Africa (Xstrata plc, 100%) (acquired Duiker Mining Ltd. assets as of 2002) | Twefontein Division (Waterpan, Boschmans, Witcons, and South Witbank mines) | 4,500. |
| Do. | do. | iMpunzi Division (Phoenix, Tavisstock, ATC, and ATCOM mines) | 6,200. |
| Do. | do. | Mpumalanga Division (Strathae, Tselentis and Spitzkop mines) | 3,200. |
| Do. | do. | Goedgevonden Mine (opens 2005) | 2,000. |
| Do. | do. | Verkeerderpan project (in planning 2002) | NA. |

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2002 ¹

(Thousand metric tons unless otherwise specified)

| Commodity | Major operating companies and major equity owners | | Location of main facilities | Annual capacity |
|-----------------|---|--|---|--|
| Coal--Continued | Duvha Opencast Services (Pty.) Ltd. (Rand Mines Ltd., 71%) | | Duvha Colliery, 18 kilometers south-east of Witbank | 11,000 bituminous. |
| Do. | Kangra Group Pty. Ltd. | | Savamore, Springlake, Taaboschpruit, and Welgedacht collieries | 4,300 bituminous and steam. |
| Do. | do. | | Secunda Collieries, 6 mines, 75 kilometers south of Witbank | 43,000 bituminous. |
| Do. | Kumba Resources Ltd. | | Grootegeeluk Mine, 120 kilometers north of Thabazimbi | 13,000 steam; 2,000 coking; 450 metallurgical. |
| Do. | do. | | Leeuwpaan Colliery in Mpumalanga Province | 1,250 steam. |
| Do. | do. | | Durnacol Mine at Dannhauser, 40 kilometers south of Newcastle | 530 coking. |
| Do. | do. | | Tshikondeni Mine in Venda, about 100 kilometers southeast of Messina | 410 coking. |
| Do. | Anglovaal Minerals Ltd. (Anglo American plc, 35%; ARMgold/Harmony Joint Venture, 34.5%; Avmin, 30.5%, as of May 2003) | | Dortfontein Colliery | 700. |
| Do. | do. | | Forzando Colliery | 1,350. |
| Do. | Eyesizwe Coal (Pty) Ltd. (Eyesizwe Holdings, 80%; Anglo Coal Ltd., 11%; Ingwe Coal Corp. Ltd., 9%) | | Matla, Arnot underground, Glisa, and New Clydesdale collieries | 18,000. |
| Do. | Kuyasa Mining (Pty.) Ltd. | | Ikhewezi mine, near Delmas (acquired from Ingwe 2002) | 350. |
| Do. | Gold Fields Coal Ltd | | Greenside and New Clydesdale collieries | 3,000. |
| Do. | Anker Holdings B.V. (Netherlands) | | Elandsfontein, Golfview, Van Oudshoornstrom, and Woestalleen collieries | 5,000. ^e |
| Do. | Wakefield Coal Division [Metorex Pty. Ltd. (Canada), 40.07%] | | Leeufontein and Side collieries in Witbank Coalfield | 1,300 steam. |
| Do. | Richards Bay Coal Terminal [BHP Billiton Plc, 37.4%; Anglo Coal Ltd., 27.5%; Xstrata Coal South Africa (Pty) Ltd., 21%] | | Coal export terminal at Richards Bay (largest in world) | 72 million metric tons per year of coal export capacity; expansion to 82 million metric tons per year by 2007. |
| Copper | Palabora Mining Co. Ltd. (Rio Tinto Ltd., 49.2%; Anglo American plc, 29%) | | Palabora Mines at Phalaborwa, include: Open pit mine (closed 2002) | 130 copper in ore. |
| Do. | do. | | Underground Mine (started-up in 2002) | 75 copper in ore. |
| Do. | do. | | Smelter at Phalaborwa | 140 anodes. |
| Do. | do. | | Refinery at Phalaborwa | 125 cathodes. |
| Do. | O'okiep Copper Co. (Pty) Ltd. [Metorex (Pty.) Limited, 89%] | | Nigramoep copper mine, near Nababeep, Northern Cape Province (closed in 2002) | 15 copper in concentrate. |
| Do. | do. | | O'okiep smelter at Nababeep | 32 blister. |
| Do. | Black Mountain Mineral Development Co. (Pty.) Ltd. (Anglo American plc, 100%) | | Black Mountain Mine near Aggeneys, 100 kilometers northeast of O'okiep | 5 copper in concentrate. |
| Do. | Maranda Mining Co. [Metorex (Pty.) Limited, 29.1%] | | Maranda zinc-copper mine in Murchison Range in Northern Province | 1.6 copper metal. |
| Diamond | thousand carats | De Beers Consolidated Mines Ltd. (Anglo American plc, 29%) | Finsch Mine, 100 kilometers west of Kimberly | 2,500. ^e |
| Do. | do. | do. | Kimberley Mines, Kimberley | 800. ^e |
| Do. | do. | do. | Koffiefontein Mine, 70 kilometers south of Kimberley | 200. ^e |
| Do. | do. | do. | Marsfontein Mine | 500. ^e |

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2002 ¹

(Thousand metric tons unless otherwise specified)

| Commodity | Major operating companies and major equity owners | | Location of main facilities | Annual capacity |
|------------------------|---|--|--|---|
| Diamond-- Continued | thousand carats | De Beers Consolidated Mines Ltd. (Anglo American plc, 29%) | Namaqualand Mines, 50 kilometers north of Port Nolloth | 800. ^c |
| Do | do. | do. | The Oaks | 130. ^c |
| Do. | do. | do. | Premier Mine, 70 kilometers east of Pretoria | 1,700. ^c |
| Do. | do. | do. | Venetia Mine, 150 kilometers north of Potgietersrus | 5,000. ^c |
| Do | do. | Namakwa Diamond Co. NL, 64%; Zaico Investments, 26%; New Africa Mining Fund, 10% | Namakwa diamond project Exploration and feasibility study in 2003 | 80. ^c |
| Diamond, synthetic | do. | De Beers Industrial Diamonds (Synthetic Diamonds Division) | Element Six manufacturing plant at Springs | 60,000 ^c |
| Do. | do. | SouthernEra Resources Ltd. (Canada), (In joint venture with De Beers Consolidated Mines Ltd. or Randgold Resources Ltd. on some operations) | Klipspringer project, includes 10 kimberlite fissures and pipes near Potgietersrus in Northern Province | 1,000. |
| Do. | do. | Benguela Concessions Ltd. | Several marine operations along Namqualand coast. Moonstone mining ship | 40. |
| Do. | do. | Trans Hex Group Ltd. | Baken deposit on Orange River; So Ver, Reuning, Komagass, and Hondklip Bay mines; 3 marine operations off Northern Province | 200. |
| Do. | do. | Trivalence Mining Corp. of Canada (100%) | Palmietgat kimberlite mine | 50. |
| Fluorspar | | Vergenoeg Mining Corp. (Pty.) Ltd. [Metorex Pty. Ltd., 70%; Minerales y Productos Derivados SA (Spain), 30%] | Vergenoeg Mine, 75 kilometers north of Pretoria | 125 acid-grade fluorspar; 10 metallurgical- grade fluorspar. |
| Do. | | Witkop Fluorspar Mine (Pty.) Ltd. (South Africa Land & Exploration Co.) | Witkop Mine, 250 kilometers west of Johannesburg | 280 acid-grade fluorspar |
| Do. | | International Metal Processing Co. Ltd. (South Africa) | Buffalo fluorspar mine (temporarily closed August 2002; to reopen in 2003) | 120. |
| Do. | | Van den Heever Fluorspar Works | Van Den Heever Mine, 120 kilometers west of Johannesburg | 50 metallurgical- grade fluorspar. ^c |
| Gold | tons | AngloGold Ltd. (Anglo American plc, 51.4%) | Vaal River operations: Great Noligwa Mine | 27.5 gold. |
| Do. | do. | do. | Kopanang Mine | 15.9 gold. |
| Do. | do. | do. | Tau Leko Mine | 9.8 gold. |
| Do. | do. | do. | Vaal River Surface operations | 3.1 gold. |
| Do. | do. | do. | Moab Khotsong Mine (opens in 2003) | 16.7 gold by 2007. |
| Do. | do. | do. | West Wits operations: Tau Tona Mine | 20 gold. |
| Do. | do. | do. | Savuka Mine | 7.5 gold. |
| Do. | do. | do. | Mponeng Mine | 14.5 gold. |
| Do. | do. | do. | Ergo operations: Slimes dam reprocessing | 11 gold. |
| Do. | do. | Gold Fields Ltd. | 3 mines west and southwest of Johannesburg: Free State (Beatrix + Oryx) Mine | 21 gold. |
| Do. | do. | do. | Driefontein Mine | 42 gold. |
| Do. | do. | do. | Kloof Mine | 35 gold. |
| Do. | do. | do. | Free State operations--shafts include Harmony 2; Merriespruit 1, 7, and 3; Virginia, Unisel, Masimong 4 and 5; Brand 2, 3, and 5; Central, Saaiplaas and Virginia metallurgical plants; and Central refinery (Virginia 2 and Harmony 4 shafts closed in 2002) | 19 gold. |

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2002 ¹

(Thousand metric tons unless otherwise specified)

| Commodity | Major operating companies and major equity owners | | Location of main facilities | Annual capacity |
|-----------------|---|--|---|---|
| | tons | | | |
| Gold--Continued | | Harmony Gold Mining Co. Ltd. | Masimong Expansion by 2005 | Additional 5.2 gold per year. |
| Do. | do. | do. | Elandskraal Mine (includes Deelkraal Mine, acquired from AngloGold in 2001) | 14.8 gold. |
| Do. | do. | do. | Elandskraal Shaft deepening by 2006 | Maintain at 14.2 gold per year. |
| Do. | do. | do. | Evander operations--includes six shafts and Kinross, Leslie, and Winkelhaak metallurgical plants (surface and 9 Shaft closed 2002) | 13 gold. |
| Do. | do. | do. | Randfontein operations---includes Cooke 1, 2, and 3, and Doornkop shafts, and Doornkop metallurgical plants (Shaft No. 4 and Lindum Mine closed in 2002) | 17.5 gold. |
| Do. | do. | do. | Doornkop South Reef development by 2007 | Additional 10.3 gold per year. |
| Do. | do. | do. | Kalgold open pit, heap leach and carbon-in-leach operation at Mafikeng, Northwest Province | 2 gold. |
| Do. | do. | Freegold Joint Venture (Harmony Gold Mining Co. Ltd., 50%; African Rainbow Minerals Ltd., 50%) | St. Helena Mine plus ex-AngloGold Free State operations: Bambanani, Tshepong, Joel, and Matjhabeng (Eland Shaft) underground mines and Free State surface operations as of January 2002 | 31.1 gold. |
| Do. | do. | do. | Tshepong North Decline Project (opens 2005) | 4.7 gold. |
| Do. | do. | do. | Tshepong South Shaft Project (in planning 2002) | Additional 6.8 gold per year. |
| Do. | do. | do. | Nyala Shaft reopening 2004? | 0.9 gold. |
| Do. | do. | African Rainbow Mining Ltd. (ARMgold) | Orkney and Welkom Mines | 17 gold. |
| Do. | do. | Avgold Ltd. (Anglovaal Mining Ltd., 60.1%) | Target Mine | 10.9 gold (2002); 15.5 gold (2007). |
| Do. | do. | Durban Roodeport Deep Ltd. | Blyvooruitzicht and Doornfontein section | 8 gold. |
| Do. | do. | do. | Northwest operations (Buffelsfontein and Hartebeestfontein Mines) | 17 gold. |
| Do. | do. | do. | Argonaut Deep project on hold (60 million troy ounce gold resource) | NA. |
| Do. | do. | Kumo Bathong Holdings, 60%; Durban Roodeport Deep Ltd., 40% | Crown section--tailings retreatment | 5 gold. |
| Do. | do. | Western Areas Ltd. (JCI Gold, 50%, and Placer Dome Inc., 50%) | South Deep Mine (2002 startup) | 12.5 gold (2001); 23.3 gold (by 2007). |
| Do. | do. | Consolidated Murchison Ltd. [Metorex Pty. Ltd., 34.3%, Crew Development Corp. (Canada), 3.3%] | Consolidated Murchison Mine, 50 kilometers west of Phalaborwa | 7 antimony concentrate; 1 gold byproduct. |
| Do. | do. | Barberton Mines Ltd. [Metorex Ltd., 54%; Millenium Consolidated Investments Ltd., 26%; Crew Development Corp. (Canada), 20%] | Eastern Transvaal Consolidated Division (Fairview, New Consort, and Sheba Mines), near Klerksdorp, acquired February 2003 from AvGold. | 2.8 gold. |
| Do. | do. | Thistle Mining, Inc. (Canada) (acquired 2002) | President Steyn Gold Mines in Free State | 5.9 gold. |
| Do. | do. | Rand Refinery Ltd. | Germiston, Gauteng Province | 1,200 refined gold. |
| Iron and steel: | | | | |
| Iron ore | | Kumba Resources (Iskor Ltd., 75%; Industrial Development Corp., 23.5%; Stimela, 1.5%) ^e | Sishen Mine at Sishen (expanding to 38 million metric tons per year by 2007) | 26,000; 27,000 ore by 2004. |
| Do. | do. | do. | Thabazimbi Mine at Thabazimbi | 2,900 ore. |

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2002 ¹

(Thousand metric tons unless otherwise specified)

| Commodity | Major operating companies and major equity owners | Location of main facilities | Annual capacity |
|----------------------------|--|--|--|
| Iron and steel--Continued: | | | |
| Iron ore--Continued | Highveld Steel and Vanadium Corp. Ltd. (Anglo American plc, 74%) | Mapochs Mine at Roossenekal, 60 kilometers west of Lydenburg | 3,000 titaniferous and vanadiferous magnetite ore. |
| Do. | Assmang Ltd. (Anglovaal Minerals Ltd., 50.4%) | Beeshoek Mine near Postmasburg | 5,500 ore. |
| Ferroalloys ² | Samancor Chrome Division (BHP Billiton Plc, 60%; Anglo American plc, 40%) | Ferrometals plant at Witbank, (6 furnaces) (2 furnaces, 110,000 capacity closed in 1999) F1 and F2 20 megawatt furnaces (80,000 metric tons per year) closed August 2000 | 450 ferrochromium. |
| Do. | do. | Tubatse Ferrochrome plant at Steelpoort (6 furnaces) | 340 ferrochromium. |
| Do. | do. | Middelburg Ferrochrome plant 35 kilometers east of Witbank (3 furnaces) | 235 ferrochromium. |
| Do. | do. | Palmiet Ferrochrome plant at Krugersdorp, 30 kilometers west of Johannesburg (3 furnaces) | 120 ferrochromium (closed November 2001). |
| Do. | do. | Bathlako Ferrochrome plant at Ruighoek, northwest of Rustenburg | 20 ferrochromium. |
| Do. | Xstrata South Africa (Pty) Ltd. (Xstrata plc, 100%) | Rustenburg (six 85,880-t furnaces) | 430 ferrochromium. |
| Do. | do. | Rustenburg slag retreatment plant | 25 ferrochromium. |
| Do. | do. | Lydenburg (4 furnaces) | 355 ferrochromium. |
| Do. | do. | Lydenburg slag retreatment plant | 24 ferrochromium. |
| Do. | do. | Wonderkop (4 furnaces) | 515 ferrochromium. |
| Do. | do. | Wonderkop slag retreatment plant | 30 ferrochromium. |
| Do. | do. | Silicon Technology plant at Ballengeich, Kwa-Zulu Natal | 55 ferrosilicon. |
| Do. | Samancor and Xstrata Joint Venture (BHP Billiton Plc, 50%; Xstrata plc, 50%) | Wonderkop furnace (2 furnaces, commissioned mid-2001) | 170 ferrochromium. |
| Do. | South African Chrome and Alloys Ltd. (Royal Bafokeng Nation, 34.4%; IDC, 24.5%) | Elandsdift and Horizon Chromite Mines | NA. |
| Do. | do. | Smelter at Boshhoek, North West Province | 235 ferrochromium. |
| Do. | do. | Pelletising plant at Boshhoek | 520 chromite pellets. |
| Do. | HFSA Investments BV [Mitsubishi Corp., 53.5%; Industrial Development Corp., 25%; ELG Haniel (Germany), 14%] (as of July 2002 merger) | Plant near Brits (2 furnaces) | 260 ferrochromium (expanding to 420 by 2005). |
| Do. | Assmang Ltd., 100% (formerly Ferroalloys Ltd.) | Machadodorp plant (4 furnaces), 80 kilometers east of Middelburg | 175 ferrochromium. |
| Do. | do. | Chromite pelletising plant at Machaadodorp | 350. |
| Do. | do. | Cato Ridge plant, 75 kilometers west of Durban | 245 ferromanganese. |
| Do. | Samancor Manganese Division (BHP Billiton Plc, 54.6%; Anglo American plc, 28.9%; other private, 16.5%) | Metalloys Ltd. plant at Meyerton (9 furnaces), 50 kilometers south of Johannesburg; can switch between ferromanganese and silicomanganese | 530 high-carbon ferromanganese; 200 silicomanganese. |
| Do. | Advalloy (Pty.) Ltd. (BHP Billiton/Samancor, 50%; Japan Metals & Chemicals Co., 35%; Mitsui & Co. Ltd., 15%) | Furnace at Samancor's Meyerton Plant | 75 low- and high-carbon ferromanganese. |
| Do. | Manganese Metal Co. (Pty.) Ltd. (Samancor Ltd.) | Plants at Krugersdorp and Nelspruit | 44 electrolytic manganese. |
| Do. | Transalloys Division (Highveld Steel and Vanadium Corp. Ltd., 100%) | Witbank | 50 medium-carbon ferromanganese. |
| Do. | do. | do. | 175 silicomanganese. |

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2002 ¹

(Thousand metric tons unless otherwise specified)

| Commodity | | Major operating companies and major equity owners | Location of main facilities | Annual capacity |
|---|-------------------------------|--|--|---|
| Iron and steel--Continued: | | | | |
| Ferroalloys-- Continued ² | tons | ASA Metals (Pty.) Ltd. (Eastern Asia Metal Investment Co. Ltd., 60%; Northern Province Development Corp., 40%) | Plant near Pietersburg, Northern Province (associated with Dilokong Chrome) | 50 ferrochrome. |
| Do. | | Rand Carbide Division (Highveld Steel and Vanadium Corp. Ltd., 100%) | Plant at Witbank, Mpumalanga Province | 58 ferrosilicon. |
| Do. | | Silicon Technology | NA. | NA. |
| Do. | tons | Vametco Minerals Corp. (Strategic Minerals Corp., 100%) | Smelter near Brits | 5,250 ferrovandium. |
| Steel | | Isacor Ltd. | Vanderbijlpark Works | 3,500 flat products. |
| Do. | | do. | Newcastle Works | 2,000 profile products. |
| Do. | | do. | Vereeniging Works | 450 ^e specialty steels. |
| Do. | | Saldanha Steel (Pty.) Ltd. (Isacor Ltd., 100%) | Hot-rolled steel coil plant at Saldanha Bay | 1,250. |
| Do. | | Highveld Steel and Vanadium Corp. Ltd. (Anglo American plc, 74%) | Witbank | 1,000 cast billets, blocks, and slabs. |
| Do. | | Columbus Stainless (Pty) Ltd. [Findiv Five Investments (Pty) Ltd., of which Acerinox SA, 64%; BHP Billiton Plc, 12%; Highveld Steel and Vanadium Corp. Ltd., 12%; Industrial Development Corp., 12%] | Stainless steel plant at Middelburg | 500. |
| Do. | | Scaw Metals Division (Anglo Operations Ltd.) | Germiston plant, Johannesburg | 500 specialty castings and rolled products. |
| Do. | | Duferco Steel Processing Ltd. | Cold-rolled slab steel at Saldanha Bay | 400. |
| Do. | | Davsteel Division (Cape Gate Pty. Ltd.) | Vanderbijlpark plant, Gauteng | 400 rebar, wire rod, and other shapes. |
| Do. | | Cape Town Iron & Steel Works (Pty) Ltd. | Kuilsrivier plant, Cape Town | 180 rebar. |
| Manganese | | Assmang Ltd. (Avmin Ltd., 50.4%) | Gloria and N'Chwaning Mines near Black Rock, 70 kilometers north of Sishen | 2,000 ore by late 2003. |
| Do. | | Hotazel Manganese Mines (BHP Billiton Plc, 60%; Anglo American plc, 40%) | Mamatwan open pit mine and Mamatwan ore sintering plant, near Hotazel | 3,400 ore, of which 1,100 is for sinter production. |
| Do. | | do. | Wessels underground mine, near Hotazel | NA. |
| Do. | | Manganese Metal Co. Pty. Ltd. (BHP Billiton Plc, 51%) | Electrolytic plant, Nelspruit, Mpumalanga | 33 manganese metal. |
| Do. | | do. | Electrolytic plant, Krugersdorp, Gauteng | 18 manganese metal. |
| Do. | | Metmin (Metorex Pty. Ltd., 100%) | Open pit mine in North West Province (used as catalyst for extracting uranium from gold) | 24 manganese dioxide. |
| Nickel | | Nkomati Joint Venture (Anglovaal Mining Ltd., 75%; Anglo American plc, 25%) | Nkomati Mine in Mpumalanga Province | 4 nickel; 0.3 copper; 3,200 kilograms PGM. |
| Petroleum, crude | million 42- gallon barrels | Southern Oil Exploration Co. (Soeker) (Government, 100%) | Oribi field 140 kilometers southwest offshore from Mossel Bay | 9.1. |
| Do. | do. | do. | Oryx field | 1.8. ^e |
| Do. | do. | Mossgas (Pty) Ltd. (Government, 100% through Central Energy Fund) | 9 wells in Mossel Bay | 3.5. |

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2002 ¹

(Thousand metric tons unless otherwise specified)

| Commodity | Major operating companies and major equity owners | | Location of main facilities | Annual capacity |
|---------------------------------|---|---|---|--|
| Petroleum, crude-- Continued | million 42-gallon barrels | Shell and BP Refineries Pty. Ltd. (Shell International B.V., 50%; BP Plc, 50%) | Sanref refinery in Durban | 60 crude. |
| Do. | do. | Caltex Oil SA Pty. Ltd. (private, 100%) | Refinery in Cape Town | 41 crude. |
| Do. | do. | National Petroleum Refiners of South Africa Pty. Ltd. (Sasol Ltd., Total SA) | Natref refinery in Secunda, 100 kilometers southeast of Johannesburg | 32 crude. |
| Do. | do. | Engen Ltd. (62%) | Gencor refinery in Durban | 38 crude. |
| Phosphate rock | | Phosphate Development Corp. Ltd. (Foskor Ltd.) (Industrial Development Corp., 100%) | Foskor Mine and plant at Phalaborwa | 3,000 phosphate rock. ³ |
| Do. | do. | Foskor Richards Bay (IDC, 100%), formerly Indian Ocean Fertilizer (Pty.) Ltd. | Plants at Richards Bay: Phosphoric acid (expanded in 2002) | 780 phosphoric acid. |
| Do. | do. | do. | Granular fertilizers | NA. |
| Do. | do. | do. | Sulfuric acid | NA. |
| Do. | do. | Fer-Min-Ore Ltd. | Glenover phosphate mine, north of Thabazimbi in Limpopo Province (opened in 2003) | NA. |
| Platinum-group metals | kilograms | Anglo American Platinum Corp. Ltd. (Anglo American plc, 69.6%) | Rustenburg section near Rustenburg, Rustenburg underground and open pit mines | 24,000 platinum metal; 10,260 palladium metal; 1,700 rhodium metal. |
| Do. | do. | do. | Rustenburg mill | 9,000,000 tons per year of ore. |
| Do. | do. | do. | Rustenburg UG2 Project (Phase I opens 2002; full production 2006, expansion production) | 12,290 platinum metal; 6,130 palladium metal; 1,200 rhodium metal. |
| Do. | do. | do. | Rustenburg UG2 Phase I mill | 4,800,000 tons per year of ore. |
| Do. | do. | do. | Rustenburg UG2 Project (Phase II opens 2005; full production 2007, replacement production for Rustenburg section) | 9,520 platinum metal; 5,200 palladium metal; 930 rhodium metal. ^e |
| Do. | do. | do. | Rustenburg UG2 Phase II mill | 4,800,000 tons per year of ore. |
| Do. | do. | do. | Rustenburg Tailings Retreatment Plant (opens in 2004; full production by 2006) | 3,730 platinum metal; 1,180 palladium metal; 265 rhodium metal. ^e |
| Do. | do. | do. | Union section, 50 kilometers south of Thabazimbi | 10,400 platinum metal; 4,850 palladium metal; 1,530 rhodium metal. |
| Do. | do. | do. | Union mill | 4,600,000 tons per year of ore. |
| Do. | do. | do. | Amandelbult section, 50 kilometers south of Thabazimbi mines | 22,100 platinum metal; 9,800 palladium metal; 6,500 rhodium metal. |
| Do. | do. | do. | Amandelbult mill | 6,000,000 tons per year of ore. |
| Do. | do. | do. | Lebowa Platinum (Atok) Mine, 70 kilometers east of Potgietersrus | 3,170 platinum metal; 2,040 palladium metal; 300 rhodium metal. |
| Do. | do. | do. | Lebowa Platinum mill | 1,600,000 tons per year of ore. |
| Do. | do. | do. | Potgietersrust Platinum Mine (30 million metric tons per year of low-grade ore mined, most of which is stockpiled for future use) | 6,570 platinum metal; 6,840 palladium metal; 510 rhodium metal. |
| Do. | do. | do. | Potgietersrust Platinum mill | 4,400,000 tons per year of ore. |

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2002 ¹

(Thousand metric tons unless otherwise specified)

| Commodity | Major operating companies and major equity owners | | Location of main facilities | Annual capacity |
|----------------------------------|---|---|--|--|
| Platinum-group metals--Continued | kilograms | Anglo American Platinum Corp. Ltd. (Anglo American plc, 69.6%) | Bafokeng Rasimone mill | 2,500,000 tons per year of ore. |
| Do. | do. | do. | Waterval Mine | 12,285 PGM. |
| Do. | do. | do. | Total Anglo Platinum mill capacity | 23,800,000 tons per year of ore. |
| Do. | do. | do. | Waterval mill | 4,800,000 tons per year of ore. |
| Do. | do. | do. | Waterval smelter (new converter plant in 2002) | 50 converter matte. |
| Do. | do. | do. | Rustenburg Base Metals Refiners Refinery | 25 nickel; 12 refined copper, cobalt, and precious metals concentrates. |
| Do. | do. | Anglo American Platinum Corp. Ltd. (Anglo American plc, 69.6%) | Anglo Platinum Converting Process (phased opening during 2003-04) | 72,000 metric tons per year of matte; 33,000 metric tons per year of nickel; 108,900 kilograms per year of contained platinum. |
| Do. | do. | do. | Precious Metals Refinery (expanding to 108,900 kilograms per year platinum capacity by 2005) | 70,000 platinum metal; 35,000 palladium metal; 6,600 rhodium metal. |
| Do. | do. | Bafokeng Rasimone Platinum Mine (Anglo American Platinum Corp. Ltd., 50%; Royal Bafokeng Nation, 50%) | Bafokeng Rasimone Mine in Northern Province (full production by 2002) | 5,050 platinum metal; 2,120 palladium metal; 330 rhodium metal. |
| Do. | do. | do. | Boschkoppie Styldrift Expansion (in study 2002) | NA. |
| Do. | do. | Modikwa Platinum Mine (Anglo American Platinum Corp. Ltd., 50%; and African Rainbow Minerals, 50%) | Twickenham (Maandagshoek) Mine (full capacity by 2004) | 5,040 platinum metal; 4,540 palladium metal; 600 rhodium metal. |
| Do. | do. | do. | Twickenham mill (to treat UG2 ore) | 2,400,000 tons per year of ore. |
| Do. | do. | Anglo American Platinum Corp. Ltd., 100% | Twickenham Platinum Mine Project (plant opens 2004, full production by 2007) | 4,980 platinum metal; 5,475 palladium metal; 1,000 rhodium metal. ^c |
| Do. | do. | do. | Twickenham mill | 3,000,000 tons per year of ore. |
| Do. | do. | Paschaskraal Joint Venture (Anglo American Platinum Corp. Ltd., 50%) | Adjacent to Twickenham Mine | NA. |
| Do. | do. | Pandora Joint Venture (Anglo American Platinum Corp. Ltd., 50%; Lonmin Plc., 50%) plus Bapo Ba Mogale Tribe and Northam Platinum Ltd. | Pandora UG2 Mine, west of Brits Lydenburg (under study in 2002) | 7,150 platinum metal. |
| Do. | do. | Booyesdal Joint Venture (Anglo American Platinum Corp. Ltd., 50%) | | NA. |
| Do. | | Anglo American Platinum Corp. Ltd., 100% | Der Brochen Platinum Project, west of Lydenburg (under study in 2002) | NA. |
| Do. | do. | do. | Polokwane Smelter (opened in 2003) | 650,000 metric tons per year of concentrates. |
| Do. | do. | Impala Platinum Ltd. (Impala Platinum Holdings Ltd., 100%) | 13 mine shafts and concentrator, near Rustenburg, Northwest Province | 15,000,000 tons per year of ore. |
| Do. | do. | do. | Smelter | 124,400 PGM per year |
| Do. | do. | do. | Enhanced precious metals refinery, near Springs, Gauteng Province | 62,200 platinum; 18,000 palladium; 4,600 rhodium. |

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2002 ¹

(Thousand metric tons unless otherwise specified)

| Commodity | Major operating companies and major equity owners | | Location of main facilities | Annual capacity |
|----------------------------------|---|---|---|--|
| Platinum-group metals--Continued | kilograms | Impala Platinum Ltd. (Impala Platinum Holdings Ltd., 100%) | Crocodile River Mine (reopened in 2001) | 1,555 platinum plus 930 other PGM. |
| Do. | do. | do. | Platexco properties, including Marula Project (formerly Winaarshoek) adjacent to Implats Clapham, Forrest Hill, and Dreikop properties; also, Platexco-Mokopane and Septre deposits | 5,500 PGM. |
| Do. | do. | Lonmin Platinum (Lonmin plc., 73%; Impala Platinum Holdings Ltd., 27%) | 3 mines (Eastern Platinum, Karee, and Western Platinum, near Rustenburg) | 37,324 PGM (in concentrates); 10,000,000 tons per year of ore. |
| Do. | do. | do. | Smelter | Matte, 6,000 grams per ton PGM. |
| Do. | do. | do. | Base Metals Refinery | Copper and nickel sulfate and PGM concentrates. |
| Do. | do. | Lonmin Platinum (Lonmin plc., 73%; Impala Platinum Holdings Ltd., 27%) | Precious Metals Refinery, at Western Platinum, 20 kilometers east of Rustenburg | 20,600 platinum; 9,330 palladium; 2,800 rhodium. |
| Do. | do. | Two Rivers Platinum (Pty.) Ltd.; Anglovaal Minerals Ltd., 41.25%; Impala Platinum Ltd., 33.75%; TISO Capital (Pty.) Ltd., 25% | Dwarsrivier Farm Underground Mine, near Lydenburg (2002 feasibility study) | 5,350 PGM. |
| Do. | do. | Northam Platinum Ltd. (Mvelaphanda Platinum, Ltd., 22.5%; Anglo American Platinum Corp. Ltd., 20%) | Northam Mine, 20 kilometers south of Thabazimbi | 13,000 platinum. |
| Do. | do. | do. | Merensky Mill | 1,800,000 tons per year of ore. |
| Do. | do. | do. | UG2 Mill | 900,000 tons per year of ore. |
| Do. | do. | do. | Northam refinery | 5,910 platinum. |
| Do. | do. | Kroondal Platinum Mines [Aquarius Platinum Ltd., (Australia), 45%; Impala Platinum Ltd., 15%] | Kroondal Mine, 10 kilometers east of Rustenburg; opened in 2000 | 3,110 platinum; 1,555 palladium; 467 rhodium. |
| Do. | do. | do. | Kroondal mill | 1,200,000 tons per year of ore. |
| Do. | do. | Aquarius Platinum Ltd. (Australia) (Impala Platinum Ltd., 25%) | Marikana Mine and Mill, 20 kilometers southeast of Rustenburg (opened 2002) | 1,540,000 tons per year of ore; 3,095 platinum; 1,210 palladium; 320 rhodium; 49 gold. |
| Do. | do. | do. | Everest South Mine (start-up planned for 2006) | 4,196 platinum; 2,047 palladium; 750 rhodium; 938 gold and other PGM. |

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2002 ¹

(Thousand metric tons unless otherwise specified)

| Commodity | | Major operating companies and major equity owners | Location of main facilities | Annual capacity |
|----------------------------------|---------------------------|--|---|--|
| Platinum-group metals--Continued | kilograms | Messina Holdings Ltd. (SouthernEra Resources Ltd., 70.4%) | Messina platinum deposit, near Klipspringer diamond mine, Limpopo Province (2003 startup) | 2,176 platinum; 1,681 palladium; 247 rhodium. |
| Do. | do. | East Daggafontein Ltd. (Mvelaphanda Platinum Ltd., 100%) | Tailings dump retreatment operation at East Daggafontein | NA. |
| Pyrophyllite | | Alpha Ltd. | Idwala Industrial Minerals plant, and Witpoort Quarry | NA. |
| Do. | | Wonderstone Ltd. (The Associated Ore & Metals Corp. Ltd.) | Pyrophyllite (wonderstone) mine, North West Province | NA. |
| Do. | | G&W Base and Industrial Minerals Pty. Ltd. | Masala Mine, Mpumalanga | NA. |
| Salt | | Salt is mined/extracted from 4 seawater and 50 salt-pan brine operations | Operations are distributed throughout the country with the greatest concentration within a major inland saltpan around the border of the Free State and Northern Cape Provinces | 400. |
| Silicon | | Silicon Smelters (Pty.) Ltd. (Anglo American plc, BHP Billiton Plc, and Pechiney Metallurgie) | Polokwane plant, near Pietersburg, Limpopo Province (3 submerged arc furnaces) | 45 silicon; 15 silica fume. |
| Synthetic fuels | million 42-gallon barrels | Sasol Ltd. (Government, 100%) | Coal to oil plant at Secunda and a coal to petrochemical plant at Sasolburg | 54.8. |
| Do. | do. | Mossgas (Government, 100% through Central Energy Fund) | Natural gas to petroleum products plant at Mossel Bay | 16.4. |
| Titanium: | | | | |
| Titanium concentrates | | Richards Bay Minerals trading for Tisand (Pty.) Ltd. and Richards Bay Iron and Titanium (Pty.) Ltd. (Rio Tinto Plc., 50%; BHP Billiton Plc, 50%) | Open cast operations, near Richards Bay | 1,280 ilmenite concentrate; ^c 125 rutile concentrate; ^c 1,000 titanium slag. |
| Do. | | Namakwa Sands Ltd. (Anglo Operations Ltd., a subsidiary of Anglo American plc, 100%) | Open cast mine near Brand-se-Baai and mineral separation plant at Koekenaap, 300 kilometers northwest of Cape Town | 540 ilmenite concentrate; 42 rutile concentrate; 123 zircon concentrate. |
| Do. | do. | | Empangeni Smelter, commissioned at end of 2002 | NA. |
| Titanium slag | | Richards Bay Iron and Titanium (Pty.) Ltd./ Richards Bay Minerals (Rio Tinto Plc.) | Smelter at Richards Bay | 1,000 titania slag; 110 rutile. |
| Do. | | Namakwa Sands Ltd. (Anglo Operations Ltd., a subsidiary of Anglo American plc, 100%) | Smelter at Vredenberg, Saldanha Bay area | 230 titania slag; 145 pig iron. |
| Do. | | Highveld Steel and Vanadium Corp. Ltd. | Steel plant at Witbank | 48 titania slag. ^c |
| Do. | | Ticor Heavy Minerals Project [Kumba Resources Ltd., 60%; Ticor Ltd. (Australia), 40%] | Hillendale Mine and Empangeni smelter near Richards Bay, KwaZulu Natal Province (full production by 2005, as shown) | 550 ilmenite concentrates; 250 titanium slag; 145 pig iron; 45 zircon; 20 rutile; 5 leucoxene. |
| Uranium oxide | tons | AngloGold Ltd. (Anglo American plc, 60%; De Beers Consolidated Mines Ltd., 40%) | Vaal Rivers operation, near Klerksdorp | 2,000. ^e |
| Do. | do. | Durban Roodepoort Deep Ltd. | Hartebeestfontein Mine and plant, 5 kilometers southeast of Klerksdorp | 400. ^e |
| Do. | do. | Palabora Mining Co. Ltd. | Palabora Mine and plant at Phalaborwa (uranium recovery ceased in 2002) | 160. ^e |

See footnotes at end of table.

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2002 ¹

(Thousand metric tons unless otherwise specified)

| Commodity | Major operating companies and major equity owners | | Location of main facilities | Annual capacity |
|---------------------------------------|---|--|---|--|
| Vanadium pent-oxide | tons | Highveld Vanadium and Chemicals Division (Anglo American plc through Highveld Steel and Vanadium Corp. Ltd.) | Mapochs Mine near Lydenburg | 25,000. ^c |
| Do. | do. | do. | Highveld steel plant in Witbank | 17,000. |
| Do. | do. | do. | Highveld Vantra plant in Witbank | 8,000. |
| Do. | do. | Vametco Minerals Corp. (Strategic Minerals Corp., USA, 100%) | Krokodilkraal Mine and plant near Brits | 5,000. ^c |
| Do. | do. | Transvaal Alloys Pty. Ltd. (Highveld Steel and Vanadium Corp., 100%) | Wapadskloof Mine and plant, 60 kilometers northeast of Middelburg | 2,250. ^c |
| Do. | do. | Rhombus Vanadium Holdings Ltd. [Xstrata plc, 100%] | Brits (Ba-Mogopa) Mine and Usko ferrovanadium plant | 13,500. |
| Vanadium pent-oxide and ferrovanadium | do. | Vanadium Technology Ltd. [Xstrata plc, 100%] | Kennedy's Vale Mine (depleted in December 2003) and plant, near Lydenburg | 5,900 vanadium pentoxide; 6,600 ferrovanadium. |
| Vermiculite | | Palabora Mining Co. Ltd. | Palabora mine and plant at Phalaborwa | 230 concentrate. ^c |
| Zinc | | Zinc Corp. of South Africa Ltd. (Kumba Resources Ltd., 100%) | Struisbult Springszinc refinery at Springs, southeast of Johannesburg | 120 zinc; 170 sulfuric acid. |
| Do. | | Black Mountain Mineral Development Co. (Pty.) Ltd. (Anglo American plc, 100%) | Black Mountain Mine near Aggeneys, 100 kilometers northeast of Okiep | 67 zinc in concentrate by 2004; 5.9 copper metal in concentrates; 68 lead by 2004. |
| Do. | | Maranda Mining Co. [Metorex (Pty.) Limited, 29.1%] | Maranda zinc-copper mine in Murchison Range in Northern Province | 13.3 zinc metal in concentrates; 5.9 copper metal in concentrates. |
| Do. | | Pering Mine (Pty.) Ltd. (BHP Billiton Plc, 100%) | Pering Mine in Northern Cape Province (depleted, closed in February 2003) | 27 zinc in concentrate; 6 lead in concentrate. |
| Zirconium | | Tisand (Pty.) Ltd./Richards Bay Minerals | Open cast mines near Richards Bay | 300 zircon in concentrate. |
| Do. | | Namakwa Sands Ltd. (Anglo Operations Ltd, a subsidiary of Anglo American plc, 100%) | Open cast mine near Brand-se-Baai and mineral separation plant at Koekenaap | 140 zircon in concentrate. |
| Do. | | Palabora Mining Co. Ltd. | Palabora Mine and plant at Phalaborwa | 14 baddeleyite. ^c |
| Do. | | do. | Zirconium basic sulfate plant at Phalaborwa | 8 zirconium basic sulfate. |
| Do. | | Phosphate Development Corp. Ltd. (Foskor Ltd.) (IDC, 100%) | Plant at Phalaborwa | 8 baddeleyite. ^c |
| Do. | | do. | Fused zirconia plant | 6 synthetic zirconia. |

^cEstimated. NA Not available.

¹Based on information available as of December 2003.

²Depending on markets, furnace capacity can switch between ferrochromium and ferromanganese.

³Most of Foskor's phosphate output is from phosphate concentrates supplied by the neighboring Palabora copper mine.

TABLE 3
SOUTH AFRICA: RESERVE BASE OF MAJOR MINERALS IN 2002 ¹

(Million metric tons unless otherwise specified)

| Commodity | Reserve base |
|------------------------------|--------------------------|
| Andalusite ² | 51 |
| Antimony | thousand tons 150 |
| Chromium, ore | 5,500 |
| Coal, recoverable | 55,333 |
| Cobalt | thousand tons 15 |
| Copper | 13 |
| Diamond ³ | million carats 1,180 |
| Fluorspar | 80 |
| Gold | thousand tons 36 |
| Iron ore, Fe content | 1,894 |
| Lead | 3 |
| Manganese | 4,000 |
| Natural gas | billion cubic meters 368 |
| Nickel | 12 |
| Petroleum | million barrels 37 |
| Phosphate rock, concentrates | 2,500 |
| Platinum-group metals | thousand tons 70 |
| Silver | do. 10 |
| Titanium | 244 |
| Uranium ⁴ | thousand tons 298 |
| Vanadium | 12 |
| Vermiculite | 80 |
| Zinc | 15 |
| Zirconium | 14 |

¹Metallic minerals are contained metal, except as noted.

²Includes the aluminosilicate and sillimanite.

³De Beers reserves and resource data only.

⁴Reasonable assured uranium resources recoverable at a cost of less than \$80 per kilogram.

Source: South Africa Department of Minerals and Energy, Minerals Economics Directorate, South Africa's Mineral Industry, 2002-2003, 192 p.